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ELECTRICAL WORLD

OCTOBER 15, 1932
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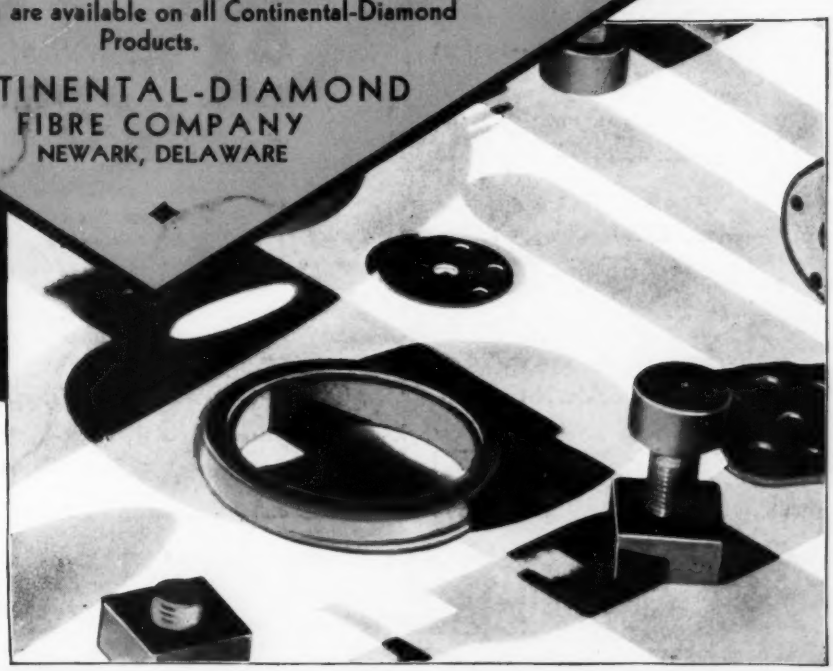

a Weston Scoop
SEPTEMBER 1, 193
LIGHT MEASURED DURING ECLIPSE
FROM DIRECT SUNLIGHT TO .008 FOOT-CANDLE RECORDED
At Magog, Canada, on August 31st during the solar eclipse, Weston Photronic photoelectric equipment faithfully indicated and recorded every variation of light intensity. This achievement gave scientists continuous and positive data of illumination variations during the total eclipse of the sun.

WRITE FOR DESCRIPTIVE LITERATURE

Weston Photronic photoelectric cell —Model 594—Booklet YY

Weston Photronic Illumination Control Relay—Model 609—Booklet E-11

Weston Photronic Industrial Control Relay—Model 612—Booklet E-11

Weston Photronic Illumination Meter —Model 603—Booklet A-1

Weston Photronic Foot-Candle Meter —Model 614—Booklet M-1

Weston Photronic Exposure Meter— Model 618—Booklet N-1

Every day science and industry are finding new applications for the amazing Weston Photronic photoelectric cell.

Its unusually high current output, its independence of power source, its constancy of characteristics, its unlimited life, its economy of installation and trouble-free operation—these features have commanded the attention of hundreds of organizations and laboratories working on photo-electric cell applications.

Weston Photronic photoelectric devices have proven themselves worthy of responsibility. Today hundreds are reliably working—simplifying operations, cutting costs, eliminating human error and guesswork. Their scope of application seems almost unlimited.

For immediate installation, Weston has developed Model 669 Photronic Illumination Control Relays for controlling illumination in accordance with daylight intensity; Model 612 Photronic Industrial Control Relays for counting, sorting, safety devices, door controls, inspection, weighing, smoke detection, and many other uses.

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ELECTRICAL WORLD

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for the Week Ending

October 15, 1932

Economic Problems Dominate Meeting of N.E.L.A. Engineering Sections

MORE than 400 engineers attended the meeting of the National Engineering Section of N.E.L.A. in Chicago, October 3-7. The committees met for a discussion of current engineering problems and reports. Chairman A. H. Kehoe reported on the revised N.E.L.A. organization and stressed the principle of making national committee work represent and reflect the geographic division activities.

Each committee reported progress and stressed the economic aspects of engineering. In the overhead systems committee active work is under way on revision of pole specifications and treatment, the economic aspects of distribution and co-ordination of insulation. Power systems engineering committee is engaged in studies of relative investments for different types of system assembly and system protection. Reports are also pending on interconnection principles, the economical development of load areas and system grounding.

Research on cables stressed

The underground systems committee submitted a draft for a serial report on methods of locating faults in cable. It includes typical methods, not as practices of specific companies but simply as an exposition of general practices. The Detroit Edison Company contributed a description of the two loop-test methods used by that company. Consolidated Gas & Electric of Baltimore described its constant-current transformer test. Tone and capacity tests are described in a paper from the Milwaukee Electric Railway & Light Company. Boston contributed descriptions of the Lundin and power bridge methods and a detailed description of the directional impulse tracing current method in use by the New York Edison Company concluded the presentations. This report was accepted by the committee and was approved for publication.

A progress report on cable joint design and construction, insulating compounds and methods and practices on low-voltage joints was submitted. This progress report is divided into eight parts, covering the installations of multi-conductor 69-kv. cable in Cincinnati, multi-conductor 35-kv. cable of the Publice Service Company of Northern Illinois, single-conductor, oil-filled, 132-kv. cable of the Commonwealth Edison Company and general practices on 13-volt cable. The report continues with discussions of split insulating sleeves, cable failures, operation of cable terminals at 75 kv. and less and test specifications.

Another item on the program was a report on research dvelopments in cable. Professor Whitehead of Johns Hopkins presented a paper on the capillary action in impregnated paper insulations. In closing the discussion Professor Whitehead asked a question which he says must remain unanswered until further research discloses a reply, "Is the success of oil-filled cable due to perfect impregnation of the paper or to the insulating value of the oil itself?"

Prof. J. C. Balsbaugh of Massachusetts Institute of Technology described the development of a bridge to measure power factors of oils to 10 to the minus 6 power. Another development was a device for neutralizing the charging currents in network feeders. (See page 521, "Three-Purpose Reactor, etc.)

The electrical apparatus committee is beginning to take a strong interest in the problem of electricity utilization on the premises of the customer. Talks on costs and on adequacy of house wiring, on wiring methods, on service entrance practices and on motor-starting currents were sponsored by the utilization subcommittee.

New wiring plan described

Materials and fittings of the new so-called "Edison" type of wiring, rumors and reports of which have been circulating through the industry for the past two years or more, were described by J. E. Noyes, Detroit Edison Company. The new wiring is of the concentric type consisting of an insulated conductor around which is wrapped a stranded bare neutral, directly over which is wound a light spiral armor. The conductor is No. 12 wire, amply sufficient to carry circuit loads to fulfill any reasonable idea of adequacy. Standard switches, outlets and receptacles are used. The idea behind the design is to supply simple materials that can be installed with a minimum of labor, the finished wiring job representing a cost for electricity utilization very much lower than most systems now in use.

The wiring method described and shown by Mr. Noyes is now being used in demonstration installations in a number of cities whose utilities are closely associated with the development. In Detroit there will be 100 installations, of which fifteen are already complete and a number of others are in progress. Cleveland has 50 to 75 jobs and installations have been made or started in a number of other cities. From experience with the method it appears that builders and workmen like the material and find it easy and fast to install. There has been some opposition of certain organized groups, but it is anticipated that such opposition will disappear when the virtues and benefits of the methods become more clearly apparent to them.

Previous to Mr. Noyes' description of the new wiring method, W. H. Horton discussed wiring adequacy. He said that there is a big difference between adequate wiring and safe wiring, and it is principally with the latter consideration that rules and regulations for wiring and methods and practices of its installation have been developed. In commercial and industrial installations it costs 200 to 500 per cent more to make an existing wiring job adequate than it would have cost to have made it adequate in the original installation.

Outlets for 16 cents apiece

The discussion of wiring and adequacy thereof was rounded out by Major H. S. Bennion, who disussed surface wiring. He stated that there is 200 ft. of lamp cord wiring in the average American home. He exhibited samples of various kinds and types of wiring materials, including conductors and fittings, which are available to the public in the 5-and-10-cent stores. With these materials any person can extend the wiring in his own home at a cost of approximately 16 cents per outlet and many thousands of persons do exactly that. They know of no code and would care little about it if they did. It seems easy to them to buy lamp cord and sockets and string them up wherever they are needed, and they do so. It was pointed out that the amount of wiring done with lamp cord and 5-and-10-cent store fittings represents a tremendous loss to electrical contractors and workmen which would represent business for them if the regulations would permit and accept the use of low-cost materials and devices.

In line with the themes of the previous talks, O. K. Coleman, Commonwealth & Southern Corporation, described the use of certain methods of installing service entrances, particularly for ranges and other heavy domestic loads.

Other committees, such as prime movers, meter, accident prevention, foreign systems co-ordination, had good attendance and made progress in their specialized work.

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Welding Engineers Hear of Advances in the Art

Recent advances in the art of electric welding were described at the American Welding Society's annual convention in Buffalo last week. These included further applications of thyratron and other systems of automatic control to the welding process, progress in fundamental research leading to greatly improved knowledge of welding phenomena and improved technique both in the actual welding process and in the training and selection of men.

In discussing the X-ray determination of the stresses in welds J. T. Norton of Massachuettts Institute of Technology concluded that "evidence is beginning to accumulate which seems to indicate that certain other physical properties of metals in addition to ductility are dependent upon perfection of the grains. . . . In welding the questions of impact resistance and fatigue resistance are of paramount importance. There can be no doubt but that these properties are profoundly influenced by the small local deformations of the grain, yet there have been no serious attempts to make a definite correlation."

As the result of research co-ordinating high-speed photography with graphic meter and oscillograph readings and with welding procedures and equipment, Gilbert E. Doan of Lehigh University and J. Murray Weed of the General Electric Company in a joint paper concluded that "liquid globules are the chief form of metal transfer, although there is some metal transfer as a vapor and mist." This is considered to apply for coated or bare electrodes.

The influence of a magnetic field parallel to the iron arc upon the welding process was discussed by F. R. Hensel and W. A. Maddox of the Westinghouse research laboratories. Recent advances in automatic electric welding with heavily coated electrodes were described by L. R. Leveen, General Electric Company.

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Pennsylvania Commission Inquiry Under Way

Pennsylvania's long-awaited inquiry into the conduct and activities of the Public Service Commission of that state is getting under way at last. The first meeting of the Rial Senate investigating committee was scheduled for Friday of this week. Inquiry of data concerning all rate cases since the inception of the commission in 1914 will be asked.

The committee comprises, in addition to Chairman Rial, Senators James J. Coyne, Charles H. Clippinger, Samuel W. Salus, William H. Earnest and William D. Pethick, all Republicans, and Warren R. Roberts, Democrat.

Meanwhile the appointment by Governor Pinchot to his hand-picked commission of C. Jay Goodnough, speaker of the state House of Representatives, has been questioned on the ground that his term as Assemblyman does not expire until December 1 and that the state constitution prohibits such an appointment even though he might resign from the Legislature to accept it.

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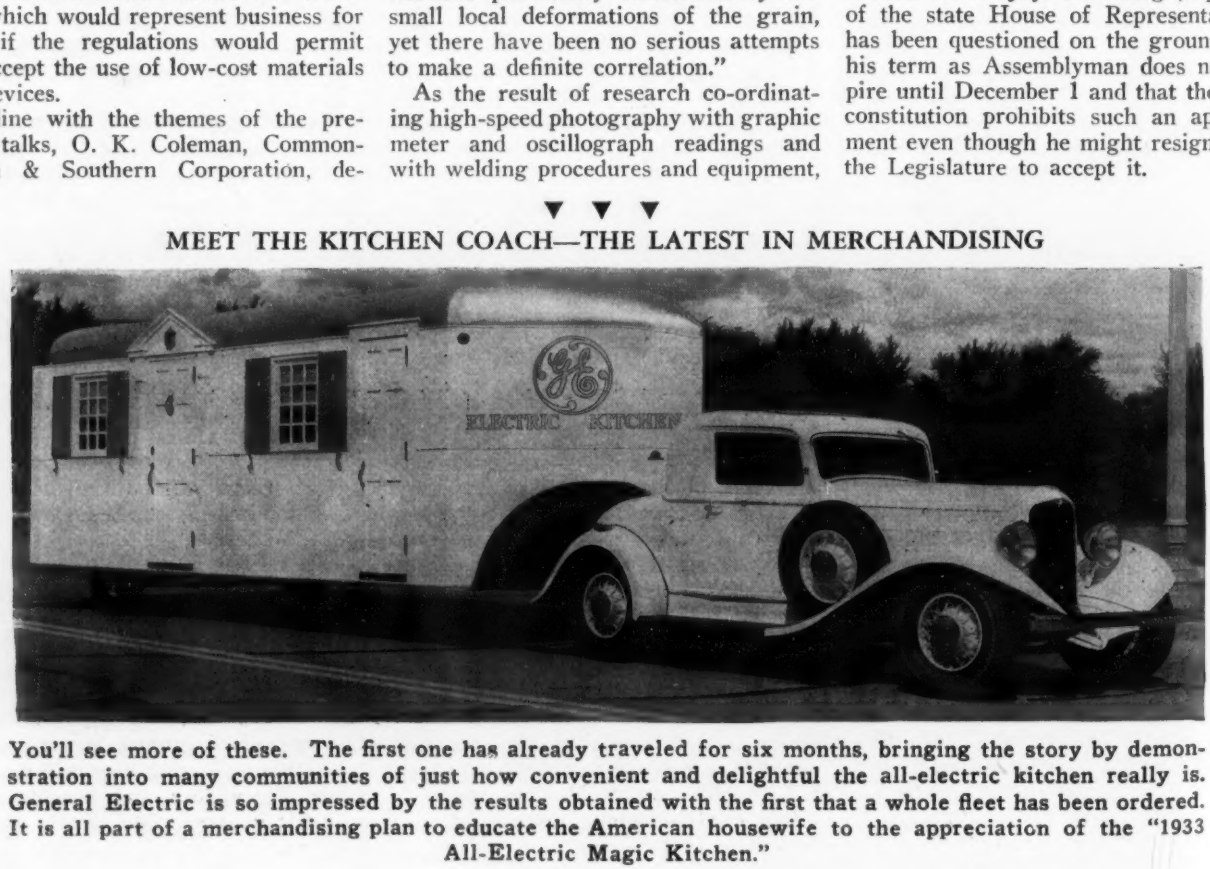
MEET THE KITCHEN COACH—THE LATEST IN MERCHANDISING



You'll see more of these. The first one has already traveled for six months, bringing the story by demonstration into many communities of just how convenient and delightful the all-electric kitchen really is. General Electric is so impressed by the results obtained with the first that a whole fleet has been ordered. It is all part of a merchandising plan to educate the American housewife to the appreciation of the "1933 All-Electric Magic Kitchen."

American Bankers Ass'n Discusses Utility Bonds

Two sides of the utility security question were presented to the delegates at the 58th annual convention of the American Bankers' Association in Los Angeles last week. W. C. Mullendore, vice-president Southern California Edison Company, warmly defended the utilities and their securities as investments, saying, in part: "I do not need to point out to you who are familiar with the facts that there is a considerable difference between bonds and other securities which are protected by the entire earnings of a soundly financed operating utility and bonds and other securities which are protected only by the marginal earning capacity of the operating utility. The operating electric utilities of the United States are sound.

"If our institutions are to be preserved," concluded Mr. Mullendore, "if democracy is to meet the test . . . then the basic industries of America must and will go on in expanding service and the creation of a rising standard of living for the American people . . . No investment is safer or better protected than the prime securities of the electric utilities of the United States."

That there are two sides to this question was brought out by the remarks of Jay Morrison, vice-president of the Washington Mutual Savings Bank and president of the savings division of the association. Mr. Morrison said, in part: "The threat of political control of rates and management of public utility corporations has impaired confidence in their securities and has led to declines in prices of certain public utility bonds. Until it shall appear that the threat to security involved through such control is averted it is questionable whether savings banks should continue to invest the funds intrusted to their care in these securities. . . . It is well that savings bankers have been slow to invest in public utility bonds. Their caution should not be relaxed."

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Dnieprostroy Dedicated; Hugh Cooper Honored

Formally dedicating the great Soviet power plant on the Dnieper River on October 10 as "Lenin's Plant," Mikhail Kalinin, president of the Soviet Central Executive Committee, announced that the Order of the Red Banner of Labor had been awarded to Colonel Hugh L. Cooper, constructor, and to five other Americans who participated in the development.

The plant has been only partly completed. Two of the five generators already in place were in operation as officials referred to Dnieprostroy as the greatest step toward realization of Lenin's dream of an electrified Russia. Four other generators remain to be installed. The full capacity of the power plant probably will not be realized until next year, when floodgates on the dam will be constructed to raise the level of the river.

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Samuel Insull in Greece; Martin Insull Surrenders

After a spectacular and dramatic ten days of swift journeys, threats of extradition, a night in police custody and final release as a more or less national hero and political issue in a country of refuge, Samuel Insull is lingering in Greece with his passport canceled by the United States. From Paris he went to Italy and thence indirectly to his present haven, from which departure is difficult. Greece has not completely ratified an initiated extradition treaty with this country. Extradition may be effected if present governmental efforts succeed.

Martin Insull, first resisting, then consenting, is now at liberty on $50,000 bail after serving 40 hours in the Simcoe County jail in Ontario. Physicians have testified him to be broken in health. Further legal steps to insure his extradition are under way. Samuel Insull, Jr., having bid his father farewell in Milan, Italy, is reported to be on his way back home by way of Paris.

Senate investigating

The United States Senate is investigating the Insull collapse. James E. Stewart, special investigator for the Senate banking committee, has arrived in Chicago, stating: "The primary purpose of this investigation is to learn what effect the Insull operations may have had on national banking and the Federal Reserve System, with a view to legislative correction of any evils discovered."

R.F.C. loan asked

Meanwhile, back in Chicago, the receivers for Middle West have applied to the Reconstruction Finance Corporation for a $21,000,000 loan to retire a debt of that amount owed to five New York banks by the National Electric Power Company. Executives of the R.F.C. are reported to have declared that there is nothing in the original act, or in supplementary provisions of it, to enable a loan directly to the receivers and that the application is therefore ineligible for consideration.

Work on a reorganization plan for United Public Service Company, a Middle West subsidiary, is reported well under way. It includes the rehabilitation of United Public Utilities Company and Southern United Gas Company.

Marked Weakness in Stocks; Indexes Steady

THOUGH no news of an adverse nature, other than the President's recounting of perils past, has developed, the stock market this week continued the slump which started late last week. General decline in market averages of about 10 points has carried prices back to where they were in early August. Bonds have shown somewhat greater resistance to decline. Commodity prices, notably grain and cotton, have dropped badly.

Trade activity continues its slow mend. Steel output rises, as do those fundamental telltales of trade weather, car loadings and energy production. Speculative sentiment appears to regard the current bull movement as having reached its peak with the wider spread realization that the dark hour before dawn, though brightened, has not yet turned to glad, confident morning; that many difficult problems still confront us, and that many anxious days are yet to be lived.

The four-week decline in commodity prices is an element that cannot be overlooked in any estimate of probable trends. That influential improvement in mass purchasing power, under present debt burdens and without sustained strength in commodity prices, can occur is hard to foresee.

A third privilege list of those participating in security offerings has been made public. Many duplications of names on the two other lists appear.

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New Jersey Rate Cut Forecast by Executive

That a state-wide reduction in the rates charged for electric service by the Public Service Electric & Gas Company might soon eventuate was predicted last week by Edmund W. Wakelee, vice-president of that organization. "It is the hope and belief of the management," said Mr. Wakelee, "that barring any substantial increase in taxes or material changes, conditions at the end of this year will permit a further reduction in rates."

Mr. Wakelee's statement came directly on the heels of a release by the Public Utilities Commission as to the success of its previous efforts to secure lower rates for the citizens of New Jersey on the basis of negotiation rather than litigation. Mr. Wakelee has confirmed the report that negotiations are even now under way.

On the basis of reproduction value, with 1931 price levels used, the rate of return to Public Service on its electric business is estimated by the commission to have been 9.88 per cent in 1931 and on the basis of a five years' average price level at 9.50 per cent.

Coming Meetings

Pacific Coast Division, N.E.L.A.—Engineering section, San Francisco, Oct. 19-20. K. I. Dazey, 447 Sutter St., San Francisco.

National Association of Practical Refrigeration Engineers—Annual meeting, Chicago, Nov. 1-4. E. H. Fox, 435 No. Waller Ave., Chicago.

N.E.L.A. Residential Sales and Industrial and Commercial Sales Bureaus. Edgewater Beach Hotel, Chicago, November 2-4. C. E Greenwood, 420 Lexington Ave., New York.

National Association of Railroad and Utilities Commissioners—Hot Springs, Ark., Nov. 15-18. James B. Walker, 270 Madison Ave., New York.

American Society of Mechanical Engineers—Annual meeting, New York, Dec. 5-9. C. W. Rice, 29 West 39th Street, New York.

American Association for the Advancement of Science—Annual convention, Atlantic City, N. J. Dec. 27-31. C. F. Roos, Smithsonian Institute, Washington, D. C.

American Physical Society—Annual meeting, Atlantic City, Dec. 28-30. W. L. Severinghaus, Columbia University, New York.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 23-27. H. H. Henline, 33 West 39th Street, New York.

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Decentralized Management Urged by Lilienthal

"If," asked David Lilienthal of the Wisconsin Public Service Commission, at the annual meeting of the American Bar Association in Washington this week, "it is a wise practice to decentralize regulation, is it not to that extent a wise practice to decentralize management?" Mr. Lilienthal cited six specific instances of typical operating-holding company relationships and transactions in which regulatory supervision of intercompany affairs would have precluded conditions supposedly contrary to public and investor interest.

"The state should not attempt, certainly at the present time, to regulate holding companies directly," Mr. Lilienthal said. "It is my judgment, however, that no system of state regulation of operating companies is complete or adequate, nor can it furnish any genuine protection to consumers and investors, unless the commissions are given ample authority over every transaction between the operating company and the holding company.

"A state commission armed with such a statute as Wisconsin and a few other states have should be able to protect the consuming public against three kinds of abuses which some holding companies have been practicing: First, abuses growing out of what I have termed 'banking transactions' with the holding company; second, abuses by way of the payment to the holding company of common dividends in excess of those which conservative business judgment would permit, at the expense of adequate provision for depreciation and surplus account, and third, abuses through the medium of unnecessary or unreasonable management and supply contracts.

"The collapse of a colossal holding company last April has done more harm to the repute of holding companies and to public utility credit in the eyes of investors than all the orders and investigations of commissions put together. In this one debacle thousands of investors lost millions upon millions of dollars as the harvest of practices which has put even well-managed and conservative holding companies under an undeserved cloud.

"In the same period not one large operating utility rendering electric, gas or telephone service has failed or defaulted. The securities of well-managed operating public utilities are the one bright spot in the gloomy investment picture at this hour. This is the record of a regulated business."

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Hydro and Dielectric Research Topics at A.I.E.E. Meeting in Baltimore

HYDRAULIC and dielectric engineers predominated at the joint meetings of the Middle Eastern District of the American Institute of Electrical Engineers and the committee on electrical insulation of the National Research Council. The hydraulic engineers found most comprehensive analysis of the Safe Harbor hydro development on the Susquehanna, beginning with a justification of the development and use of Kaplan turbines, by F. A. Allner, and terminating in the story of revamping of the receiving system in Baltimore to make most effective utilization of the capacity and the energy. Cavitation commanded most of the attention in the discussion. Several engineers deplored the tendency to leave laboratory analysis and experimentation toward specific designs to the prospective user. Professor Spanhake of Massachusetts Institute of Technology and Karlsruhe stated that if cavitation pitting were a chemical phenomenon materials research would provide the answer, but that if it be primarily mechanical the solution is less hopeful.

One distinct element in the papers and the discussion was the growing favor of the Kaplan type turbine for values of head above the low values for which it has admittedly had a physical superiority. The 50 per cent excess cost by comparison with equivalent fixed blade wheels in the lower ratings tends to shrink to small value for the 50,000-hp. ratings.

The groups of papers disclosed two other hydraulic trends. One is the tendency to shorten the width of the hydro building in the axis of stream flow and the other to lengthen the hydraulic works under the plant in order to realize the greater outputs and efficiencies obtainable through fuller control of the flow from gate to tail race.

In the electrical realm the noteworthy feature was the high degree of reliability built into the 220-kv. line to Baltimore. This single-circuit line has functioned excellently through a winter and a summer and is relied upon at times as the sole source of power for the whole Baltimore area. Such confidence is founded on the added insulation, added phase-to-ground clearances, wider cone protection by ground wires, more extensive crowfoot and counterpoise grounding than was incorporated in earlier Eastern lines of this rating.

Meanwhile the cable and dielectric engineers were canvassing the progress that had been made in the insulation of telephone wires by pulp deposit, the substitution of 7,000-volt spark testing of rubber-insulated wire for the 1,000-volt immersion test and the perfection of formulas and technique for predicting power cable behavior under abrupt and short time loading. In the first instance the wire, after it has had the pulp deposited on it in a cylindrical layer, is subjected to an air temperature of 1,500 to 800 deg. F. to dry it down to about 7 per cent moisture. The speed is 130 ft. per minute, so the paper is not charred, but the deposit is rendered somewhat porous, by a "puffed rice" phenomenon due to the explosive elimination of the water. Continued progress in dielectric research was reported to the National Research Council group. While these reports continue in wonted volume, it was pointed out that this is the result of momentum in research, much of the financial support from the industry having been withdrawn from the university laboratories.

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Broad River Case Slowed by Refusal to Give Costs

Refusal of officials of the Broad River Power Company to supply cost figures to the South Carolina Railroad Commission has slowed the commission's hearing on an order for the company to reduce its rates by approximately $170,000 a year. Mandamus proceedings are threatened to compel disclosure of the price paid for the Columbia Railway, Gas & Electric Company in 1924. R. D. Jennison, president of the company, has however, offered to testify before the commission if a definite date be set.

W. C. Herbert, electrical engineer testifying for the commission, stated that

in taking up five of the fourteen electrical accounts in the power company's appraisal he found an overvaluation of nearly $2,000,000.

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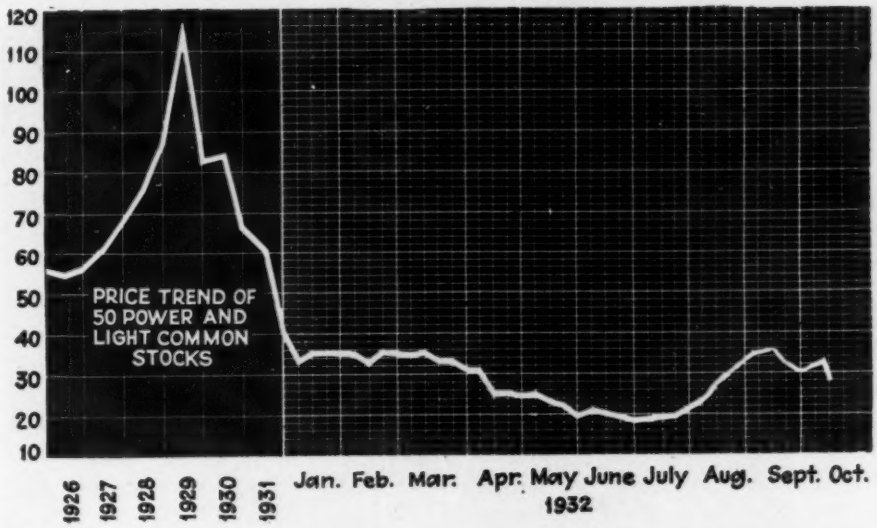
Central Maine Stabilized Preferred-Stock Market

Effective stabilization of preferred-stock prices was effected by the Central Maine Power Company during the past summer's market fluctuations. Following the discontinuance of the practice of selling this type of treasury security on June 1 it was realized that a number of stockholders were selling their preferred shares at any price obtainable during June. Knowing that there were many people wishing to buy preferred stock at these "throw-over" prices, the company began selling stock again on July 5. Orders were taken subject to confirmation to deliver stock at $65 or lower per share for the $6 dividend stock and at $70 or lower per share for the $7 preferred. Stock was bought by the company in the open market to fill these orders. The price charged was the purchase price plus a small commission.

Within three days the company's salesmen were able to obtain orders for more than three times the amount of stock which could be acquired at the cheaper prices. The bid for this stock was raised step by step since July 5, until on September 30 the company had on hand orders for the $6 stock at $90 per share and for the $7 stock at $95. Apparently buyers are in excess of sellers. The company also resold all customers' stock offered from whatever source. This was done to protect any customers wishing to resell at the current order price. A commission of $2 per share was charged. The effect of this program has been to make a ready market for the company's stock well above the level of quotations for similar securities. While customers have not been able to realize the full amount originally paid for their stock, they have realized an amount far in excess of most other securities with which they have parted. The position of the preferred shares as bank collateral has also been greatly strengthened by the company's policy.

Stocks Decline Sharply



Losses were sustained all along the stock list during the past week, bringing to a halt the upward trend which characterized early October. Utility stock prices dropped from 32.2 to 28.1.

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Current Earnings Reports of Electric Light and Power Companies

Operating Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Alabama Power (Year ended July 31)					
Gross earnings....	$16,452,129	$17,943,818	— 8.3	49	47
Net earnings.....	8,431,197	9,501,379	—11.2	..	..
Net profit.....	1,511,026	3,041,542	—50.3	..	..
Consumers Power (Year ended July 31)					
Gross earnings....	29,420,560	31,539,018	— 6.7	50	52
Net earnings.....	14,728,371	15,181,276	— 3.0	..	..
Net profit.....	6,263,184	7,567,808	—17.2	..	..
Duquesne Light (Year ended July 31)					
Gross earnings. ..	26,406,912	28,500,558	— 7.3	43	43
Net earnings.....	15,128,812	16,343,473	— 7.4	..	..
Net profit.....	11,404,757	13,343,829	—14.6	..	..
Kansas City Power & Light (Year ended August 31)					
Gross earnings....	14,734,175	14,856,746	— 0.8	60	60
Net earnings.....	5,966,480	5,953,889	0.2	..	..
Net profit*.....	4,302,256	4,394,132	— 2.1	..	..
Northern States Power† (Year ended July 31)					
Gross earnings....	33,296,658	33,801,613	— 1.5	58	57
Net earnings.....	13,974,295	14,376,892	— 2.8	..	..
Net profit.....	3,116,968	3,835,441	—18.6	..	..
Oklahoma Gas & Electric‡ (Year ended July 31)					
Gross earnings....	11,344,723	12,696,699	—10.7	59	60
Net earnings.....	4,655,899	5,068,074	— 8.1	..	..
Net profit.....	1,117,756	1,607,347	—30.5	..	..
Tennessee Electric Power (Year ended July 31)					
Gross earnings....	12,635,781	13,957,736	— 9.5	58	61
Net earnings.....	5,319,764	5,480,565	— 2.9	..	..
Net profit.....	1,206,388	1,792,187	—32.8	..	..
Virginia Electric & Power (Year ended July 31)					
Gross earnings....	16,149,350	17,091,791	— 5.5	65	67
Net earnings.....	5,577,961	5,695,937	— 2.1	..	..
Net profit.....	2,536,577	2,790,447	— 9.1	..	..

Holding Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Commonwealth & Southern and subsidiaries (Year ended August 31)					
Gross earnings....	$119,841,769	$134,091,051	—10.6	53	54
Net profit.....	8,056,491	15,887,913	—49.5	..	..
Electric Power & Light and subsidiaries (Year ended July 31)					
Gross earnings....	76,830,661	85,098,416	— 9.7	57	57
Net profit.....	1,329,817	4,991,862	—73.4	..	..
Engineers Public Service and constituent Cos. (Year ended July 31)					
Gross earnings....	48,961,313	53,561,199	— 8.6	63	65
Net profit.....	2,941,039	3,992,914	—26.3	..	..
National Power & Light and subsidiaries (Year ended July 31)					
Gross earnings....	74,693,939	79,592,154	— 6.1	60	62
Net profit.....	8,092,419	9,301,143	—12.9	..	..
Public Service Corp. of New Jersey and subsidiaries (Year ended August 31)					
Gross earnings....	130,999,456	141,558,493	— 7.5	66	67
Net profit*.....	29,818,587	31,820,768	— 6.3	..	..

* Balance available for preferred and common dividends.

† Operating expenses for 1932 include $175,000 credit for withdrawal from contingent reserve.

‡ Operating expenses after deducting $128,505 in 1932 and $179,907 in 1931 withdrawal from contingent reserve.

Gross earnings — (Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Net profit — Balance available from income for common stock dividends.

Weekly Energy Output Rises

WITH 1,506,209,000 kw.-hr. in the week ended October 8, central-station energy output increased 0.5 per cent compared with the preceding week. Except for the interruption due to Labor Day this is the eighth consecutive increase announced by the National Electric Light Association, and makes a total rise of 6.4 per cent over the production in the week ended August 13. Output was 8.9 per cent less than in the like week of last year, thus repeating the ratio of the preceding week. The maximum disparity between the two years occurred in the middle of July and amounted to 13.9 per cent.

Closer approach to last year's operations is indicated in the Central industrial area, now down only 10.8 per cent, against 15.3 per cent three weeks earlier. This was balanced by a slightly increased disparity on the Atlantic seaboard, off 4.4 per cent from 1931, and a somewhat larger one on the Pacific coast, with New England off 2.4 per cent.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
October 8	1,506	1,653	1,724	1,806
October 1	1,499	1,646	1,711	1,819
September 24	1,491	1,660	1,714	1,778
September 17	1,476	1,663	1,722	1,792
September 10	1,444	1,582	1,727	1,806

Per Cent Change from 1931

Region	Week Ended Oct. 8	Oct. 1	Sept. 24
Atlantic Seaboard	— 4.4	— 4.2	— 6.9
New England alone	— 2.4	— 1.6	— 6.0
Central industrial	—10.8	—11.1	—13.8
Pacific Coast	—10.1	— 8.6	— 8.1
United States	— 8.9	— 8.9	—10.2

▼

Canada's Energy Output Approaches 1931 Levels

Central-station electrical energy output continues to run under last year's in Canada as in the United States, but the approach is closer in the northern country. According to the Dominion Bureau of Statistics, August production was 1,231,013,000 kw.-hr., only 2 per cent less than a year ago, whereas in the United States public utility plants generated 12 per cent less energy than in August, 1931.

Of Canada's August output only 24,367,000 kw.-hr. was generated from fuel. This is approximately the usual proportion. Total July output was somewhat smaller, 1,156,439,000 kw.-hr., down 7.5 per cent from 1931, with 22,884,000 kw.-hr. from fuels.

The relative progress appears to be due primarily to increased activity in the pulp and paper industry, a heavy consumer of electrical energy. Thus, compared with August, 1931, output from water-power in Quebec increased 3 per cent, but decreased 8 per cent in Ontario, 4 per cent in British Columbia and very slightly in the Maritime Provinces; 54 per cent of the total was generated in the one province of Quebec.

▼

St. Lawrence Plan Hit in Campaign Textbook

Democratic opposition to the St. Lawrence waterway treaty is indicated by certain passages in the recently issued campaign textbook of that party. The joint committee of ten members provided for by the treaty is also assailed.

"The St. Lawrence project and waterways might as well be a Muscle Shoals and a Panama Canal as far as state's rights are concerned, should this treaty go into effect without change," the article says.

"It represents a presumption and assumption of federal power that should be opposed by every state and its people concerned with preserving the inherent rights on water power, within its jurisdiction, for the sole benefit of the people of a state and the public at large. It is another example of government by federal commission, repulsive to the fundamentals of democracy."

▼

Associated Hearing Ends; Columbia G. & E. Next

Following an adjournment, for the present, of the hearings into the activities and policies of the Associated Gas & Electric system the Federal Trade Commission announces that on October 18 it will resume its holding company inquiry with the presentation of testimony, by its examiners, of the affairs of the Columbia Gas & Electric Company.

Final sessions in the hearings of the Clarion River Power Company, an Associated property, brought testimony by examiners to the effect that there was "no evidence obtainable" that the General Construction Corporation had ever done any work for the $2,550,000 construction item charged to Clarion River's books for building the Piney hydro station on the Clarion River. "All the available information," said Mr. Nodder, the examiner, "indicated that the charge made by this company covered discounts on securities as well as a possible bonus to some company." He added that access to desired records covering some of these transactions were denied to the examining staff of the commission.

Methods by which Associated secured the outstanding preferred stock of the Clarion River Power Company in 1928 at a loss of approximately $4,000,000 were described by Mr. Nodder at the final hearing on October 5. Associated, after acquiring control of the Clarion company, offered an exchange of securities for the participating preferred stock which many of the stockholders declined, but under which those who accepted the offer encountered a complete loss when the Clarion company was sold to another company under a mortgage foreclosure in March of this year.

▼

Big Steel Plant Buys Power

Recent decision by the management of the Sparrows Point plant of the Bethlehem Steel Company to purchase all but that portion of its power derived from its own manufacturing by-product brings a normal 50,000-kw. load to purchased-power service. Consolidated Gas,

Electric Light & Power engineers anticipate in normal times under this contract a consumption by this plant of 240,000,000 kw.-hr. a year, though use at present runs about 7,000,000 kw.-hr. a month.

▼

Armored Cable Suit Asks $3,000,000 Damages

Demanding triple damages amounting to $3,000,000 as allowed in the Clayton and Sherman anti-trust acts, the Circle Flexible Conduit Company, Inc., has sued the National Electric Products Corporation in the U. S. District Court, New York, alleging the latter, through false claims of patent rights, to have sought to monopolize trade in armored cable. Others named in the suit are three officers and directors and A. Penn Denton as engineering director of the National Electrical Manufacturers' Association.

The complaint alleges that the corporation in the fall of 1929 conspired with its licensees to restrain commerce by prohibiting the manufacture, sale and shipment of armored cable of a graded type manufactured by the Circle Flexible Conduit Company.

The conspiracy was furthered, it is charged, by license agreements, price fixing and threats. The suit specifically charges that the National threatened to destroy the plaintiff's business unless it ceased to manufacture graded armor cable, and that it also threatened to reduce the price of "A B C" cable below the price of production.

As a result of the threats, the suit recites, the plaintiff was forced to take out a license from the defendant, but in March of 1931 repudiated the license and declined to "participate further in the alleged unlawful conspiracy." Later, as a result of this action, the National sued the present plaintiff for infringement of patent rights in federal court, Brooklyn, but lost its action. The Circle Flexible Conduit Company alleges that it has been damaged to the extent of $500,000. It demands an additional $500,000 in punitive damages, and both sums are trebled in its demand for relief.

▼

Build Inventories, Is Plea and Action of Rand

Leading manufacturers of the nation are urged by James H. Rand, Jr., chairman of the board Remington Rand, Inc., to increase their payrolls for at least 60 days as a means of boosting the public buying power so that the present upward trend may be turned into a solid revival.

Announcing that his own company was increasing its payrolls 50 per cent and expected to have its eight major plants on a four-day-per-week basis before long, Mr. Rand says that more than 3,000 men and women have been called back to work and that his company's payrolls are up 25 per cent.

The time has come for concerted action by all manufacturers to increase employment and expand public buying power if industry is to consolidate these gains into a real recovery, even if it means increasing the inventory of finished goods, Mr. Rand declared.

▼

Wage Scale Varied With Class of Work

The Electrical Workers' Union and the Electrical Guild are reported in Cleveland to have announced a new wage scale with variations to conform with the class of work done. It is reported that members will charge $1.37½ an hour for new construction work, $1.05 for modernization and 75 cents an hour for maintenance. The previous rate for any class work was $1.50.

According to Clair C. Killen of the Society of Industrial Engineers, who proposed to the Cleveland union the plan which it adopted, it is an economic waste to build new, modern structures that would depreciate the value of existing buildings which through modernization could be made serviceable. The union is therefore taking the position of discouraging overbuilding, not primarily because the union might not profit temporarily at least from new construction, but to avoid the later effects upon investors and ultimately to spare themselves the distant repercussions of such overbuilding and investment depreciation.

▼

23,100-Ft. Cable Order

Said to be one of the largest cable orders ever fabricated, the Okonite-Callender Cable Company has shipped the Brooklyn Edison Company a 23,100-ft. production in what is thought to be record time for manufacture. Eight 3,300-ft., 26,000-volt, three-conductor, steel-armored, submarine power cables were involved. Delivery of the first length was made in nine days and the whole shipment made in less than seven weeks. The cables have been installed in the East River and are part of the project which was described in ELECTRICAL WORLD on page 276 of the August 27, 1932, issue.

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Subway Rectifiers Ordered

Contracts have just been awarded for the mercury-arc rectifying equipment of the Houston Street line of New York's partially completed independent municipal subway. The Eighth Avenue division has been in operation for several weeks. Allis-Chalmers was awarded the new contract, which involves more than $500,000, and will include not only rectifying equipment but transformers and various incidental control apparatus.

Major New Construction This Week

APPROPRIATION of $250,000 is being arranged by Eastern Shore Public Service Company, Salisbury, Md., for transmission and distribution, including 40-mile high-tension line.

Motors, panelboards, conveyors and accessories needed for new silk mill at Atmore, Ala., of Rieback & Mandell, Inc. Estimated cost $100,000.

Fund of $105,000 has been secured by Madison, S. D., for additions to city-owned electric plant.

Transformers, accessories, motors, regulators, refrigerating machinery and conveyors will be installed in produce terminal of Southern Pacific Railroad Company, New Orleans, La. A $500,000 project.

Heavy-duty motors, regulators, loading and conveying equipment needed by Elizabeth (N. J.) Brewing Corporation. Cost about $200,000.

Bids soon asked by United States Engineer Office, St. Paul, Minn., for locks and dam on Mississippi River, including equipment for lock operation, control and lighting. Cost about $1,000,000.

Pumping machinery, heavy-duty motors, transformers and conveyors needed for new sewage disposal plant at Jackson, Mich. Cost $660,000.

▼

Wisconsin 1932 Taxes

About $7,600,000 will be paid in Wisconsin in 1932 by street railways, electric light and power companies and by conservation and regulation companies in the form of taxes, it is announced by the State Tax Commission. Street railways were assessed $287,850,000, on which the tax is $5,582,489. Light, heat and power companies, privately owned, were assessed $82,964,000, tax $1,686,801; municipally owned properties assessed $724,850, tax $14,734. Conservation and regulation companies were assessed $2,650,000, tax $53,879.

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New York Metal Prices

	Oct. 4, 1932 Cents per Pound	Oct. 11, 1932 Cents per Pound
Copper, electrolytic	6.25	6.25
Lead, Am. S. & R. price	3.25	3.00
Antimony	5.625	5.625
Nickel ingot	35.00	35.00
Zinc, spot	3.45	3.40
Tin, Straits	24.25	24.10
Aluminum, 99 per cent	23.30	23.30

Attacking the Tax-Free Myth

In Oklahoma the Oklahoma Utilities Association has undertaken a definite program to bring to the attention of the citizens the misleading practices of the Public Ownership League in presenting alleged facts about tax-free towns which have their own municipal power plants. In Minnesota the tax-free town myth is being fought with facts through data compiled by the Minnesota Taxpayers' Association.

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Philadelphia Show a Success

More than 60,000 persons visited the fifth annual Electric and Radio Show which closed in Philadelphia on October 1 after a six-day career. About 200 booths contained exhibits by national and local interests.

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Utility Pays Taxes in Advance

Alabama Power Company last week paid to the state treasury $277,382 in settlement of the hydro-electric kilowatt-hour tax for 1931. This payment was not due until November 1, but the possibility that schools might have to close for lack of funds led the company to make the payment in advance.

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Connersville (Ind.) to Cut Costs

Reduction of levies for city lighting as an economy measure, to come within provisions of the recently passed $1.50 maximum tax law, is agitated in Connersville, Ind. The city has a contract with Public Service Company of Indiana, expiring February, 1936, but the levy reduction would abrogate it. This is said to be the first time a city has made a determined effort to break a contract with any Indiana utility.

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Empire State Association Elects

At the recent meeting of the executive committee of the Empire State Gas and Electric Association officers were elected as follows for the coming year: President, Alfred H. Schoellkopf; vice-president, Charles L. Cadle; treasurer, Francis J. Brett.

▼

Truce in Airport Controversy

Postponement of further construction work on the transmission line of the Consolidated Gas, Electric Light & Power Company near the Baltimore, Md., airport for one year may offer a way out in the dispute between local aviation interests and the utility organization (ELECTRICAL WORLD, August 27, page 257). Such a proposal on behalf of the company is based upon the assumption that the permanent airport at Dundalk will have been finished by then and that completion of line erection near Logan Field at that time will be satisfactory to the interests of aviation and flying safety. The offer is under consideration by the city.

▼

Municipal Rate and Tax Cuts

City Commissioners of Ottawa, Kan., have announced a reduction of 1 cent per kilowatt-hour in the domestic-commercial rate—from 5 to 4 cents—as well as a reduction in power rates. Although the new rate schedules will reduce surplus profits of the municipal plant $25,000 annually, the city, it is claimed, will still be able to apply a yearly profit of $60,000 toward tax reduction.

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Tennessee Rates Cut

Electric rates in Tennessee were cut for the second time this year, when the State Railroad and Public Utilities Commission ordered lower residential and commercial rates for 25 of the 28 Tennessee towns served by the Kentucky-Tennessee Light & Power Company.

▼

G. E. Use of Electric Heat

General Electric Company has installed in its various plants about 60,000 kw. of electric heat devices. These in 1929 consumed some 100,000,000 kw.-hr. in industrial processing work, approximately the annual consumption of a typical American city of 100,000 population.

▼

Frigidaire Shows Large Gains

Unit sales for September were 43 per cent higher and dollar sales 28 per cent higher than in August, the Frigidaire Corporation announces. It is said that a marked improvement occurred in all sections of the country, with outstanding increases east of the Mississippi.

▼

Street Lighting in Detroit

Overtures by the American Street Lighting Company of Baltimore for the business of that nature in Detroit, Mich., are meeting with continued opposition in the latter city. The municipal Lighting Commission has declared that "in view of the fact that this company has stated definitely that its only object in making a lower price is for advertising purposes, and in view of the fact that on its first proposal it was not below our costs, but was higher, and not desiring to disrupt our present organization it was moved that the commission not ask for a new proposal, but rather disapprove any further consideration of one it believes is aimed at municipal ownership."

Energy Use in Studio Hits Peak

Electrical energy use in the Paramount Studios in Hollywood in September was the greatest at any time in the 21-year history of the studio. Here, as elsewhere, the use of electrical energy serves as a close gage of the business activities of the business. During September 746,000 kw.-hr. was recorded. The previous peak, in 1931, was 350,000. The employment of 205 electricians was the largest since 1928.

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Safety Award to Wisconsin Again

For the third time in four years Wisconsin Public Service Corporation has received the highest award of the National Safety Council for safe operation and prevention of accidents to employees in the combined gas and electric group, having 500 or more employees. This company had but three lost-time accidents, establishing the extremely low frequency of 1.070, or slightly over one accident for each million man-hours of active employment. First place for electric companies with more than 500 employees was won by Central Power & Light Company of Texas.

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Government Favors Air-Conditioning

New buildings of the U. S. government are in many cases provided with air-conditioning equipment. Contracts have just been closed for the Department of Justice and Supreme Court buildings in Washington, D. C. In the former a plant with an equivalent cooling capacity of 2,000 tons of ice, said to be the largest to have been ordered by the government to date, has been provided for.

▼

Marketing Air Conditioning

In a special report "Marketing Electric Air Conditioning," just released, the general power committee of the National Electric Light Association has endeavored to cover the essential commercial phases of this topic. Consideration has been given to general definitions, applications in typical industries and commercial buildings and an organization for sales results has been outlined. Performance data of equipment and cost tabulations are included.

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Columbus Municipal Cuts Rates

Pursuing an avowed program to boost the income of the Columbus, Ohio, municipal power plant from $400,000 to $800,000 a year the city Service Director announces reductions in rate schedules which will make them "lower in every instance than those of the Columbus Railway, Power & Light Company," which also serves the city.

Pressure Circuit Breakers Offer Several Advantages

Through a design which is said to offer increased mechanical strength, reduced bulk, simple construction and accessibility as well as a high rupturing capacity in relation to the space required, Brookhirst Switchgear, Ltd., of Chester, England, claims to have produced a radical improvement in oil circuit breaker practice.

It is explained that while the principle of quenching the arc by means of moving oil is regarded as ideal, owing to the lack of a reliable and economical method of creating and controlling the oil movement, the production of commercial circuit breakers working on this principle has proved a difficult problem. In this design an oil pump operated by the switch and placed in the center of a ring of contacts constitutes a simple and inexpensive element for oil control.

When the switch is opened a pump piston is forced down by a spring behind it so that a bodily movement of oil under high pressure is produced. The whole body of oil in the lower compartment of the switch tank is placed under controlled pressure, and when breaking the circuit the arcing chamber is entirely filled with a body of moving oil.

In this respect the scheme differs definitely from the oil-jet method of operation. As the oil pressure is definitely predetermined, it takes immediate control of the arc and gas bubble.

An 11-kv., 900-amp. circuit breaker of this type has been developed to the production stage, but 33-kv. wet types may be developed with but slight design modifications, it is said.

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Three-Purpose Reactor Solves Network Problem

Charging kva. of a feeder cable supplying a low-voltage network may not be negligible in comparison with the reactance of the network and its transformers. The relative magnitudes may even be such as to create a series resonance condition during the interval while the network protector is opening under the influence of reverse magnetizing current flow to a feeder on which the breakers have opened at the station. Lamp voltages rise with risk of burnout and the relay problem in general is complicated.

The General Electric Company, tackling such problems arising on the Buffalo and Brooklyn networks, has developed a shielded five-legged core reactor which has gaps in the supplementary cores calculated to give the device triple functions. It serves as a capacitance compensator or shunt reactor, a grounding transformer with neutral resistance and a loss-control device under conditions of line-to-ground fault on the feeder. Rise in voltage and charging current under feed-back to the grounded cable energized only from the network is limited by the inherent low-reactance characteristics of the three-legged core portion under unbalanced magnetization attending fault conditions. Grounding reactance is controlled by the reluctance proportioning of air gas in the flux paths offered by the fourth and fifth legs. A supplementary nonmagnetic shield of relatively low resistance surrounding the assembly both controls unbalanced magnetization loss and presents undue heating in the tank itself.

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New Drumm Battery Train Has Some Improvements

So successfully has the first Drumm battery train operated in its scheduled runs on the Great Southern Railway in Ireland (ELECTRICAL WORLD, May 21, page 882, and December 12, 1931, page 1029) that a second train similar to the first but with added improvements in battery arrangements has been placed in operation.

The new train is covering 178 miles a day with complete satisfaction and Dr. Drumm has expressed the opinion that it is possible to cover 300 miles during a day of fifteen hours. About 80 miles is accomplished on a single charge, it accelerates to 20 m.p.h. in 25 seconds and is automatically charged by the raising of a pantograph when coming to rest at a charging terminal.

The charging capacity is of a relatively high order, each station being capable of suppling energy at 630 volts d.c. with a capacity of 900 amp. continuously or 1,000 amp. for a period of 30 minutes and with a special high charging rate of 1,350 amp. for two minutes.

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Standards Bureau Studies Insulating Liquids

Based upon the assumption that one of the most important directions in which technical progress can be made in the electrical industry lies in possible improvement of the insulators used, the U. S. Bureau of Standards has undertaken a study of various liquid dielectrics. These liquids, the bureau contends, are never perfect and constitute a continuous loss of power.

Commercial insulating liquids are cited as involving numerous chemical compounds, some of which are good, some indifferent and some poor insulators. The Bureau of Standards in its investigation has first studied pure chemical compounds in an attempt to find those with the best insulating properties. The normal hydrocarbon series has been chosen because liquids of this series are among the best-known insulators and are constituents of commercial insulators. Observations are now being made on the electrical properties of these liquids.

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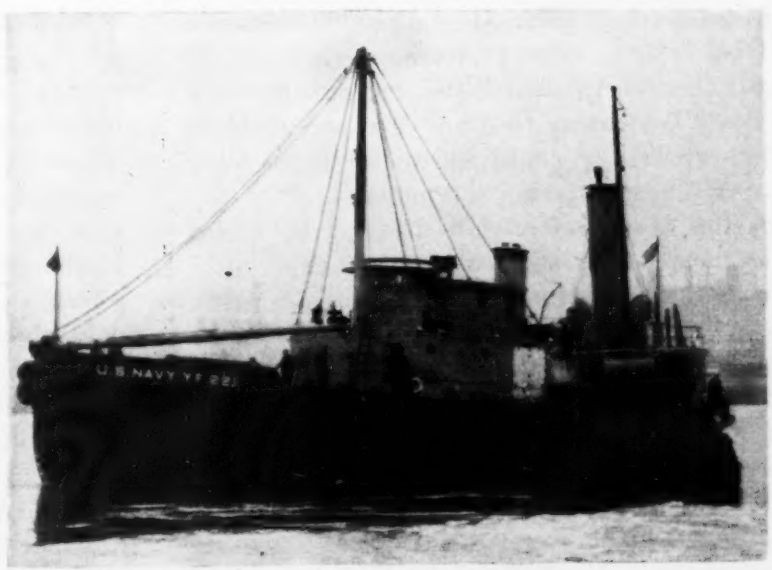
NAVY'S ALL-WELDED LIGHTER LAUNCHED



U. S. Navy YF 221, an all-welded lighter, was launched at the Brooklyn Navy Yard several weeks ago. Allegedly the largest vessel of this form of construction to have been built for the navy, she is one of a group of nineteen which will replace obsolete craft and train designers, engineers and welders in the application of basic principles to navy work.

EDITORIALS

L.W.W.MORROW
Editor

The matter of appliance testing

DISCUSSION continues on the advisability of establishing an official laboratory for testing and approving domestic electrical appliances. This approval would definitely label a refrigerator, a range, a flatiron or a percolator as efficient and dependable or it would deny the label and brand it as sub-standard. There are two schools of thought.

The advocates of appliance testing cite the experience of the gas industry and urge that such a central laboratory would relieve the expense now borne by the power companies in their own testing and also aid the public to secure the utmost in utility. The opponents assert that such a system of approval tends to degrade quality and retard progress, because every appliance that bore the label would claim perfection, which would becloud relative values. They question the ability of any laboratory to grade the dependability and believe that it would add to the cost of the goods, without benefiting the public.

But the average electrical man, as he listens to the argument, is inclined to take neither side, and asks this pertinent question, Does the public want to be protected beyond the consideration of safety? For people have a God-given right to decide what they like and what they do not want. Through experience, men and women learn to judge quality in silk and wool, in hardware and groceries. As electrical appliances become better known in the home, won't this problem of quality solve itself? Also, it is worth considering whether it will not cost less of the electrical industry's money to teach the public how to judge quality in electrical appliances than to establish grade symbols, police them and educate the buyer to recognize them and depend upon them. There is an honest difference of opinion and a round-table discussion should be held to clarify thoughts and formulate action if necessary.

In a discussion of appliance testing, in a recent meeting, a laboratory enthusiast voiced the opinion that there should be a requirement of 600,000 ohms insulation resistance in each range. To which a market-minded wag replied, "What we ought to be talking about is how to overcome the resistance to putting an electric range in 600,000 'omes." And, after all, isn't he right?

From the cradle to the grave

FOR some years comment has been heard that the professional engineering societies neglect to deal with the economic status of engineers. Now comes the news of an ambitious program for engineers that places the professional societies on an economic and psychological plane far above that obtained by other professions. In brief, a National Council will act for the co-operating societies to help select, train and stamp approval on engineers.

Starting with the preparation and selection of proper types of students, there will be developed yardsticks for measuring college courses and standards for graduation. Then will come the selection and guidance of young engineers through the apprentice or training period following graduation, and last comes a survey whereby those found worthy will be labeled engineers and endowed with accredited certificates. This is an ambitious and untried road beset by many pit-

falls and false paths, but it is significant of the times. Human relations now rate with technical relations even in the conservative engineering societies. Every encouragement should be given this work, for it will be successful only through painstaking effort for many years. It marks the initiation of new and broader thought and action by professional societies.

Locating defective insulators

OF THE many possible applications of the cathode-ray oscillograph for the protection of transmission and distributing systems, one of the first to be suggested was the location of defective insulators on overhead lines. The approximate location of the defective insulator was easily deducible from the time interval on the oscillogram between the instant of application of an outgoing impulse and that of its return as reflected from the ground. It was very soon found that such detection was possible in the cases of dead grounds. This simple method, however, is limited to grounds of very low resistance and the method is not practicable for detecting insulators which are in the incipient stages of failure. To detect these, higher valued impulses with resulting flashover are necessary, and there are obvious objections to the use of these from the standpoint of possible damage to other insulators and terminal apparatus. In addition the accuracy of the determination falls off the less serious the fault.

A further study of the possibilities of this method are reported in the *Archiv für Elektrotechnik,* May 18, 1932, in which it is shown that by a more careful analysis of the oscillograms and by the introduction of an auxiliary frequency it is possible to pick up a defective insulator at a very much earlier stage of its progress toward failure than was heretofore possible. The application of a 50-kv. impulse to a 100-kv. line indicated a defect at a distance of 21.85 km., and the defect was actually found at a distance of 21.95 km. The method in this case depends upon the time difference between the reflected wave from a partial discharge at the defective insulator and the reflected wave from the extreme length of the line, together with the values of the amplitudes, all of which are immediately read on the oscillogram. The method so far is subject to the disadvantage that the line must be cut out for measurement, but has the obvious advantages of a reduction of the magnitude of the test impulse, and apparently remarkable accuracy.

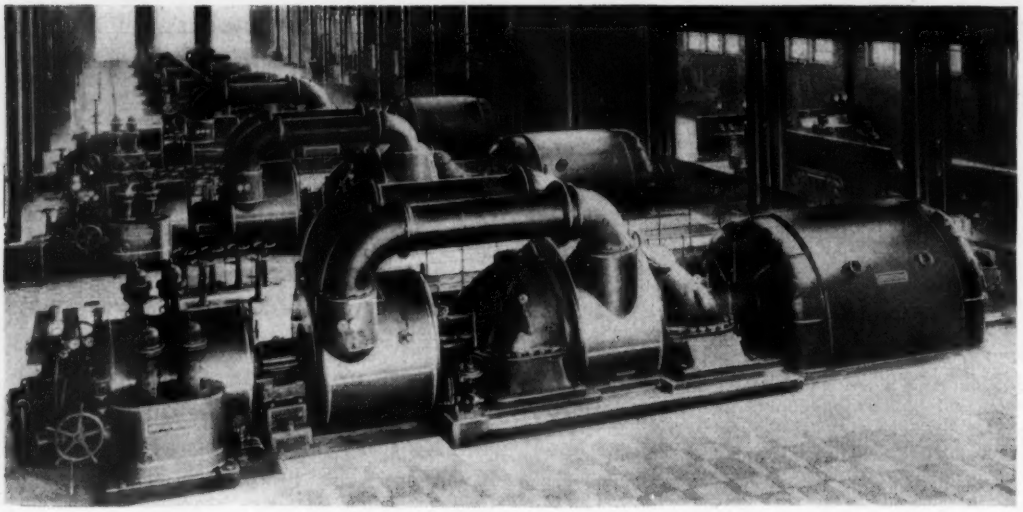
Electric steam boilers

A SURVEY of Canadian installations of electric boilers for the production of steam reveals that the kilowatt capacity of such boilers approaches one-fifth of the total hydro-electric capacity of the Dominion. This large figure prompts an analysis of the economics of the use of such forms of steam generators and the use of power for such purpose.

Many contracts cover power furnished on a horsepower-year or kilowatt-year basis to paper mills and other industries which also require large quantities of steam. In such cases electric steam boilers have been installed to use "when and if available power"; that is, power up to the limit of the contract not at the moment required by the industry. In this case the cost of equivalent coal is saved at the expense of fixed and operating charges on the electric boilers, which latter costs are comparatively low.

The completion of several new hydro plants has placed large blocks of electric power on the market for which, on account of the depression, there is no present demand. Such power has been sold to industries close to transformer stations at such low rates as to permit steam production at lower costs than with coal. Electric boilers may be obtained at low first cost in sizes up to 25,000 kw. each. Even when high depreciation rates are charged against the electric boiler plant, industries find it profitable to buy such power for steam generation only. These power contracts for steam generation only have, as a rule, been for only three- to five-year periods.

Rates for such current to electric boilers barely pay interest charges on the hydro-electric plant which generates the power and on the transmission line and transformers. Obviously such contracts can only be considered as temporary until other industrial demands for power develop with returning prosperity. It is evident, then, that the present large consumption of electricity for the generation of steam in Canadian plants is a passing condition and that these extremely low rates for such power cannot become permanent. American conditions do not warrant the practice.



36-kv., 31,250-kva. generator in Langerbrugge station, Belgium

By PAUL R. SIDLER
Resident Engineer
Brown, Boveri & Company, Ltd., New York City

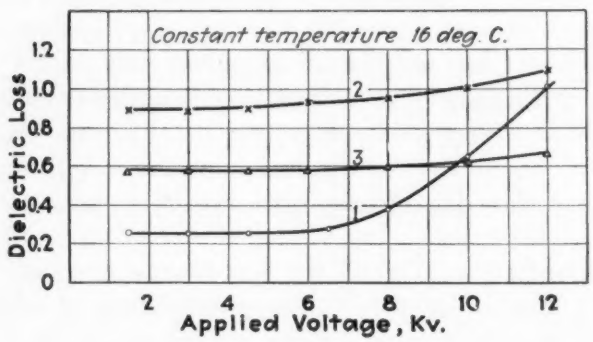
36-Kv. Generators Arise from Insulation Research

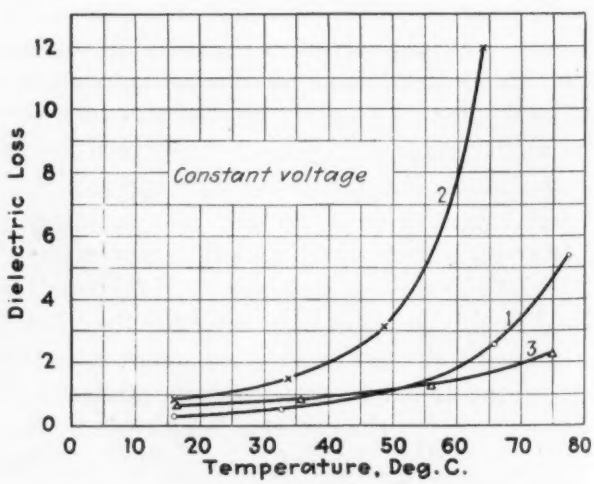
EXTENSIVE research has been carried on in recent years in the field of electrical insulating material which to a large degree helped to develop cables up to 110 kv., overhead lines, circuit breakers and transformers up to 220 kv. and generators up to a rated voltage of 36 kv.

The experience gained in the manufacture of high-voltage cables (where insulation is subdivided into various layers of different dielectric constant) has led the way for designers of electrical machines to an application of the same principles. Considering that in such machines the conductors are subject to different voltages to iron, Parsons designed in 1929 a 33-kv. generator with slot insulation in three layers (Fig. 4). For such a disposition of the winding it is necessary to connect the neutral point rigidly to ground as the single layers, of course, could not stand the full rated voltage. Other designers have proceeded along similar lines, in many instances increasing the number of individual layers.

Radically departing from this practice, Brown Boveri constructed a turbo-generator for 31,250 kva. and a terminal voltage of 36,000 volts which was delivered early in 1931 to the Langerbrugge power station of the Centrales Electriques des Flandres et du Brabant in Belgium. A cross-section of the bar and the twisting of the conductors to reduce the eddy-current losses due to skin effect are shown in Figs. 5 and 6. The complete bar is fully insulated against ground and protected against accidental disturbances of the potential distribution, for instance, by steep-front waves.

To obtain an equally distributed insulation of sufficient strength, such as shown in Fig. 5, it was necessary to develop a new insulating material, as the existing mica preparations did not give satisfactory results. This was mostly due to the presence of shellac as a binding





Figs. 1 and 2—Relative dielectric losses of three types of generator insulation

1 = ordinary insulation with 18 per cent varnish.
2 = ordinary insulation with 62 per cent varnish.
3 = improved insulation with 33 per cent varnish.

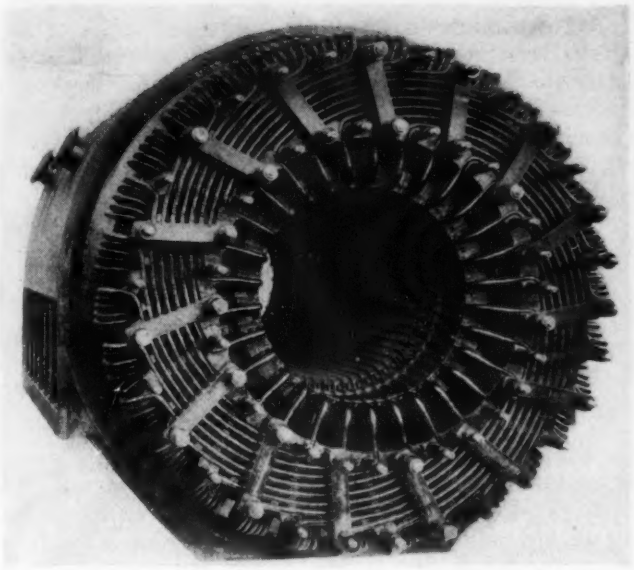


Fig. 3—Stator of 36-kv. generator
Note welded steel frame and rugged supporting structure for coil-ends

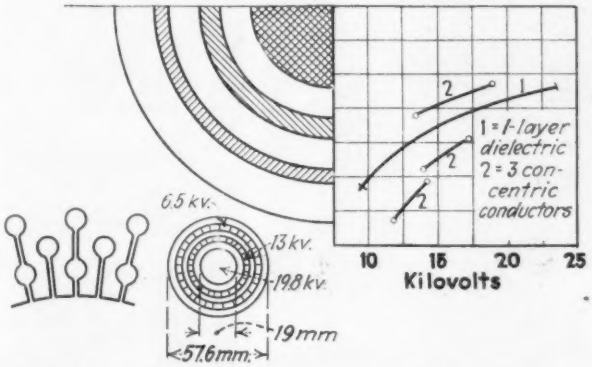


Fig. 4—Insulated generator bar of 33-kv. generator and stress distribution

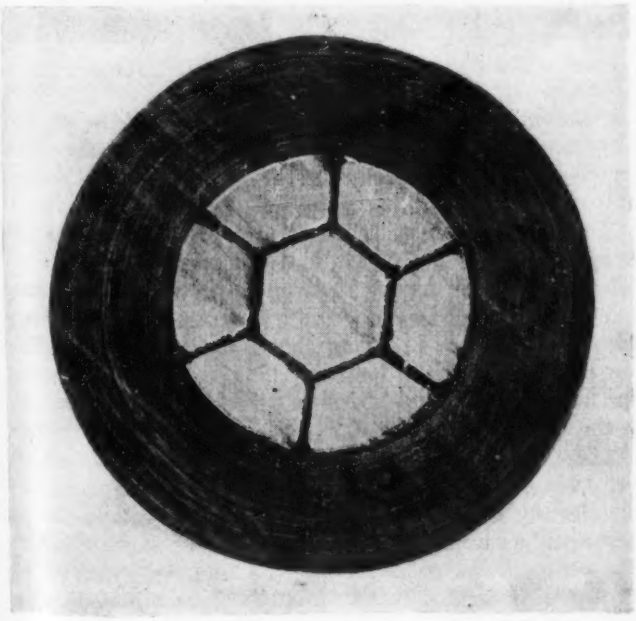


Fig. 5—Section through 36-kv. generator bar

agent. It is well known that shellac begins to soften at comparatively low temperatures and then tends to swell the insulation. If, on the other hand, the manufacturing temperature is increased, shellac hardens and at least partly loses its adhesive capacity.

Tests with various practical combinations of the three components of micafolium—mica, varnish and paper—resulted in an improved insulating material, containing 33 per cent of a special varnish. The dielectric losses of ordinary insulation with 14 per cent varnish (shellac), 62 per cent varnish and of this improved material are shown in Fig. 1, all in terms of the applied voltage. The same preparations at constant voltage, but with varying temperature are shown in Fig. 2. It will be seen from these curves that the improved material shows only slightly varying losses with increasing voltage and very small variations of losses with increasing temperature. Both these qualities, combined with the high dielectric strength of this new material, make it extremely useful and valuable for high-voltage insulations of machine windings, especially as its mechanical properties are not only equal but superior to those of ordinary mica preparations.

Further studies were conducted with a view to improving the insulation outside the slot and particularly at the edge of the iron. By suitable corona protection and a layer of semi-conducting varnish it has been possible to impress test voltages up to 100 kv. with scarcely visible discharges. For the finished bar windings of the 36-kv. generator previously mentioned breakdown voltages better than 200 kv. were reached.

Fig. 6—Twisted stator conductor used in 36-kv. generator

Development of high-voltage machines has at all times been closely related to the results of tests on insulating material. Since 1897, when the first generators for 13.5 kv. were built by Brown Boveri for the Paderno power station in Italy, this development was in steady progress, embracing such stepping-stones as the several 22-kv. generators built by the General Electric Company for a plant near Chicago, the turbo-generator of 33 kv. already mentioned, designed by Parsons & Company, Ltd., of England, and as a third step in this direction, the 36-kv. turbo-generator for Langerbrugge.

Judging from the excellent results of the new insulating material mentioned 36 kv. represents by no means the possible limit. If a test voltage of 110 kv. is withstood for one minute, a rated voltage of about 50 kv. would be allowed if based on the I.E.C. regulations. In the case of three-phase generators with a solidly grounded neutral this would amount to a security against breakdown of about seven times. It may thus be said that even for considerably higher operating voltages than used up to the present time the problem of insulation has been solved with satisfactory practical results.

Strength Requirements Affect Rural Line Costs*

Practically all engineers use the National Electrical Safety Code as their limiting guide, particularly regarding strength requirements.

The Safety Code permits in rural areas what is known as "Grade N" construction, for which the Code lays down no strength requirements. "Grade N" simply implies that the line must be strong enough to stand up without stating under what particular conditions of load and stress. It is the practice of most engineers to specify construction in accordance with what the Safety Code calls "Grade C." This permits stressing poles to 100 per cent of their ultimate strength initially, conductors to 60 per cent and guy wires to 75 per cent, all under the condition of maximum load. This type of construction is required by the Code for rather thickly populated areas or heavily traveled highways even though in rural sections. Certainly it is unreasonable to expect to load poles to more than 100 per cent of their ultimate strength. As to conductor tension, the elastic limit for hard-drawn copper is about 55 per cent of ultimate strength and for steel-cored aluminum conductors about 70 per cent. Therefore, 60 per cent seems to be about as high as should be permitted in a construction specification.

For the purpose of determining the conditions of maximum mechanical load, the Code divides the United States into three areas, known as heavy, medium and light loading areas.

Maximum loading for these three areas is described as follows: Heavy loading—horizontal wind pressure of 8 lb. per square foot on the projected surfaces of conductors and poles, when conductors are coated with a ½-in. radial thickness of ice at a temperature of zero degrees Fahrenheit. Corresponding values for medium loading are 8 lb. wind, ¼ in. ice, 15 deg. F., and for light loading, 12 lb. wind, no ice and 30 deg. F.

New York State is included in the heavy loading area.

It is this difference in loading requirements which makes a large difference in the normal tension and sag of the conductor, thereby making a decided difference in the maximum permissible span length with a given height pole. These factors make a difference in costs in the pole and fixtures account of about $150 per mile between heavy and medium loading districts and $225 between heavy and light loading districts.

Proper design requires a suitable balance between the initial cost and the annual operating and maintenance costs. The ideal design is one for which the sum of the annual interest charges on the initial investment plus the annual operating and maintenance costs is the lowest possible to obtain. Cheapest materials are often most expensive in the long run, therefore the line of the lowest initial cost may be far from reaching the ideal of lowest total annual cost.

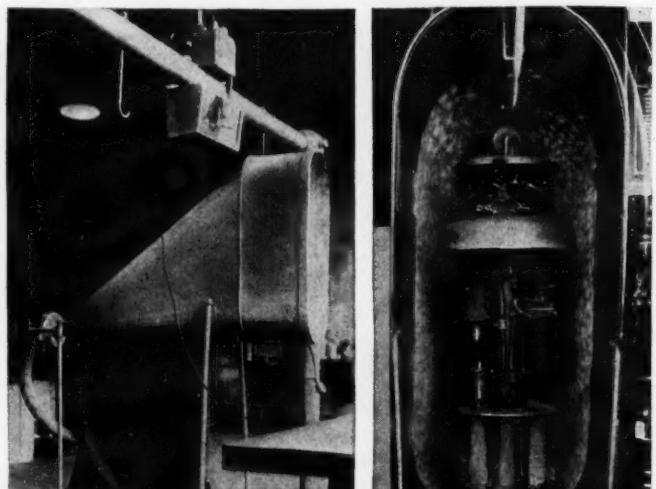
All of the lines built by the utility companies of New York State are designed with the thought that it is a grave mistake to skimp so much initially that larger conductors or a street-lighting circuit, or additional transformers or secondaries or an additional primary wire, to change from single to three phase, cannot be added without costly rebuilding.

The next installment will suggest questions which should be answered when any one claims he has built a "low-cost" rural line.

▼

Dustless Cleaning of Arc Lamps

Blowing compressed air into the interior parts of an arc lamp brought into the shop for repair is a fine way of cleaning them, but it has its disadvantages. The finely divided carbon and metal particles thus blown into the air are unpleasant to breathe and in time are dangerous to the health of the repair men. In the street-lighting maintenance department of the Toledo Edison Company the speed and thoroughness of compressed air cleaning are retained, but the discomfort and danger of the dust are eliminated by the device illustrated.



No more dust from cleaning arc lamps

The flat sheet metal cone with a vacuum cleaner unit at its small end and with the dust collector bag hanging below is wheeled up to the lamp repair rack. The large end of the cone has a longitudinal slot at the top through which the hanger holds the lamp about a foot back in the cone. When the lamp is being cleaned the vacuum unit draws all the dust back into the cone and deposits it in the bag below.

The device is useful also in the unwinding of burned-out solenoids. When the wire is pulled out of them they become the center of a cloud of charred cotton on silk dust, just as unpleasant as that from the lamp cleaning. By setting these coils over a stud in the bottom of the open end of the cone and running the vacuum unit these coils can be unwound without any dust spreading into the room.

Second installment of excerpts from report of electric technical committee on construction standards and cost of rural distribution lines, Empire State Gas and Electric Association. See "Electrical World," October 8, 1932, page 507.

Electric Range Oven Performance

By J. T. LITTLETON and C. J. PHILLIPS
Research Laboratory, Corning Glass Works

Relative use of radiation and convection heating.
Type of baking vessel affects efficiency materially.
Test data show opportunities in oven design.
Sixty per cent saving in energy through choice of dish

EFFICIENT ovens for electric ranges must be designed with a full understanding of heat insulation and of heating by convection and radiation. Heat loss must be kept at a minimum by insulation and the principles of radiation and convection heating must be used to get the heat from the electric heating elements into the foods quickly and efficiently.

Convection heating in an electric oven depends upon the difference in temperature between the air in the oven and the baking dish and food. Some design control of this part of the heating may be had through design of baking dish surface and dimensions, air volume and air circulation, but essentially heat is transferred by this process to the food through baking dishes that are heated by the circulation of the air in the oven.

Radiation heating, however, is a direct transfer of heat from a hot body to a cold body that requires no physical transfer medium. Hot heating elements emit heat radiations in proportion to the fourth power of their temperature, and this radiant heat is directly absorbed, transmitted or reflected, depending upon the characteristics of the walls of the oven, the baffles, the baking dish and the food. Essentially an efficient oven that uses radiant heat should have the hottest possible heating element, the greatest possible reflection by oven walls and baking dishes of the greatest possible heat-absorbing and transmitting capacity.

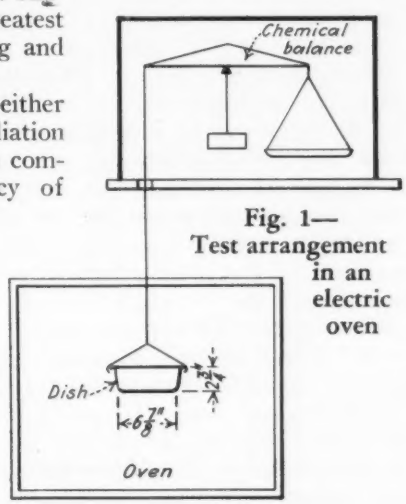


Fig. 1—Test arrangement in an electric oven

With the use of either convection and radiation heating, or the two in combination, the efficiency of the oven is the ratio of the power absorbed by the food in the cooking process to that consumed by the oven. It should also be stated that both radiation and convection heating require intelligent oven design to focus and control each kind of heating or their combination, so that the usual household cooking may be done satisfactorily as well as efficiently. The surface and the material of the baking vessels used in an oven have a very material effect on radiant heat absorption and transmission, but it is also true that the location of heating elements and the color and kind of inside finish of the ovens also affect reflection greatly. Moreover, the proper distribution of the radiant heat in an oven for cooking satisfactorily is also a desirable objective in oven design.

Primarily to determine the influence of baking dishes, tests were made on a leading type of electric range oven sold for domestic use. The oven used was 16 in. wide, 14 in. high and 18 in. deep, with heating units in both top and bottom, each controlled by a separate switch. The heating elements on the top were exposed to the oven interior, but those on the bottom were covered by a sheet metal baffle plate. During the tests the oven temperatures were held constant to within about ± 1 deg. F. by two manually operated rheostats. Each temperature was the average of those recorded by three iron-constantan couples placed symmetrically about the center of the oven.

The test method consisted in evaporating known amounts of water at oven temperatures of 300, 400 and 500 deg. F. from covered vessels of various materials. The procedure was to place 800 grams of water in the vessel each time, with an excess of 50 grams to allow for evaporation previous to actual measurements. The vessel was then placed in a wire frame (having a very small contact area against the vessel) and then suspended in the exact center of the oven from one arm of a very accurate Sartorius beam balance. This set-up is shown in Fig. 1. In each case the oven was maintained at the fixed temperature for about 40 minutes so that the water might reach its maximum temperature.

The resultant data give the time to evaporate equal weights of water. The fact that, as evaporation continues, the water level falls and hence the total wetted area changes offers no difficulty, as this very slight change is nearly constant in all cases. Water evaporation rates were shown to be a measure of the rate of cooking by cooking tests on a variety of foods in different dishes.

The relative amounts of convection and radiation heat available in an oven can be determined by a comparison of the heating rates on one dish which is heated almost entirely by convection with that on another exactly similar dish which in addition utilizes all the radiation energy present; that is, a highly reflecting dish in the first instance and a perfectly absorbing dish in the second. The baking dishes used for preliminary tests were two exactly similar "Pyrex" brand casseroles, the one silvered and polished and the other heavily coated with lamp black.

Since it is known that glass reflects only about 5 per cent of the radiation striking it, one would expect the lamp black coat to add very little to the absorbing power

of the uncoated glass casserole. Preliminary experiments showed this to be the case as there was no appreciable difference between the results obtained with the uncoated and the blackened glass. Therefore the uncoated glass was used in general for the later measurements as the absorbing dish and a small correction factor applied to take into account its reflection loss. On the other hand, the polished silver surface is not a perfect reflector, absorbing about 2 per cent of the radiation. The heat used by the silvered dish is thus convection heat plus 2 per cent of the available radiation, while that used by the uncoated glass is convection plus 95 per cent of the available radiation. Hence the data furnish sufficient information to compute the relative amounts of radiation and convection heat available.

In Fig. 2 are shown the heat absorption curves for the "Pyrex" brand and silvered casseroles and the same curves corrected for the radiation absorption of the silver and the reflection loss of the glass. The corrected curve on the silver shows the heat transferred by convection alone. The difference between the two corrected curves is the heat transferred by radiation alone.

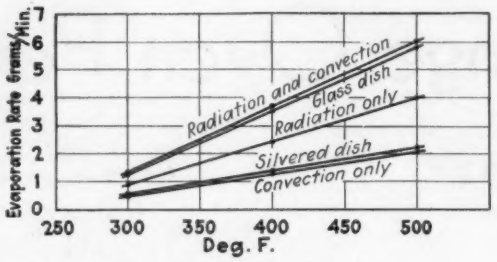


Fig. 2—Heat absorption data for different dish surfaces

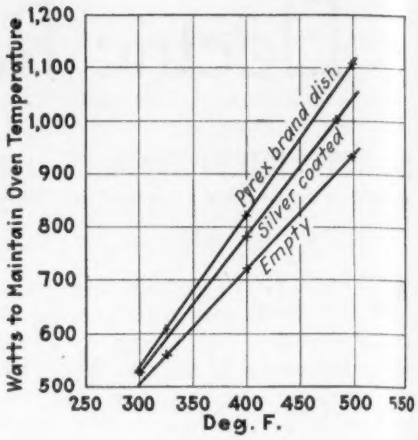


Fig. 3—Power-temperature curves for electric oven

Tests were made to determine the amount of radiation and convection heating in the oven and tests were then made to get comparable data on evaporation as affected by baking dish surface and material. The measurements made on the metal dishes agreed within 1 per cent with the results computed from the data in Table I after making the necessary correction for the slight absorption of the metal.

The power-temperature curve for the oven was determined in the evaporation tests with both the uncoated and the silvered glass casserole. The results are given in Fig. 3.

The power absorbed by the dish is determined by the evaporation rate at the given temperature. This can be converted to watts by a proper conversion factor. The theoretical oven efficiency is obtained by dividing this quantity by the oven power as taken from the power-temperature curve.

A study of the results in Table III shows that the efficiency of the oven is more than doubled when the type of cooking vessel is changed. The total efficiency of the oven can be increased, of course, by using more than one dish at a time.

It might be expected that the thermal conductivity of the dish material would also materially affect the results, but this is not the case. The absorption of heat by the surface of the dish depends upon its temperature in relation to its surroundings, and while the temperature of the glass dish surface is slightly above that of the metal dish surface, the difference is not large enough to alter appreciably the amount of heat being absorbed.

The highest oven efficiency is therefore obtained with a baking dish which utilizes both the convection and radiant heat. This efficiency can be utilized in practice by cooking with the absorbing dish for either shorter times at the same temperature used for the reflecting metal or by cooking for equal times at equivalent temperatures, equivalent temperatures being those temperatures which give equal evaporation and hence equal cooking rates. The theoretical efficiency of these two operations are not the same as is shown in Table IV.

In the table for the equivalent temperatures the power consumed is computed using the same time in the oven for the absorbing dish as for the reflecting dish. For equivalent times the data are compared on the basis of the power used by the "Pyrex" brand dish to give the same amount of cooking.

Table I—Relative Amounts of Radiation and Convection in the Electric Oven Tested

Temperature, Deg. F.	Radiation, per Cent	Convection, per Cent
300	64.8	35.2
400	66.8	33.2
500	67.2	33.8

Table II—Comparable Data on Evaporation as Affected by Baking Dishes

Temperature, Deg. F.	Glass, per Cent	Shiny Metal, per Cent
300	100	42.3
400	100	37.9
500	100	37.5

Table III—Theoretical Oven Efficiency Affected by Baking Dishes

	Oven Power		Absorbed Power		Oven Efficiency	
Oven Temp. Deg. F.	Uncoated Glass Casserole, Watts	Silvered Glass Casserole, Watts	Uncoated Glass Casserole, Watts	Silvered Glass Casserole, Watts	Uncoated Glass Casserole, per Cent	Silvered Glass Casserole, per Cent
300	540	525	47.9	20.3	8.8	3.9
400	820	780	131.2	49.7	16.0	6.4
500	1,105	1,040	217.5	81.6	19.7	7.9

Table IV—Savings Possible by Choice of Baking Dishes

Glass Dish		Reflecting Dish		Difference per Year in 600 Hours' Use,
Oven Temp., Deg. F.	Power, Watts	Oven Temp., Deg. F.	Power, Watts	Kw.-Hr.
300	540	390	755	129
325	610	470	960	213
350	680	505	1,050	222

	Glass Dish		Reflecting Dish		
Oven Temp., Deg. F	Hours' Use per Year	Kw.-Hr.	Hours' Use per Year	Kw.-Hr.	Saving, Kw.-Hr.
300	253.1	136.7	600	315.0	178
400	228.1	187.0	600	468.0	281
500	225.5	248.7	600	624.0	375

As a result of the tests the following conclusions may be drawn:

1. The efficiency of an electric oven depends upon the temperature of the oven, the ratio of radiation to convection heat and the reflecting power of the material of the dish. In the case of a "Pyrex" brand dish the oven efficiency was found to be 8.8 per cent at 300 deg. F. and 19.7 per cent at 500 deg. F. This efficiency is more than twice that obtained with a dish having a reflecting surface.

2. In the electric range investigated the available heat consisted of about one-third convection heat and two-thirds radiation heat.

3. Saving in power in one year's oven use of 600 hours can amount to as much as 375 kw.-hr. when a non-reflecting material instead of a reflecting material is used for a cooking vessel.

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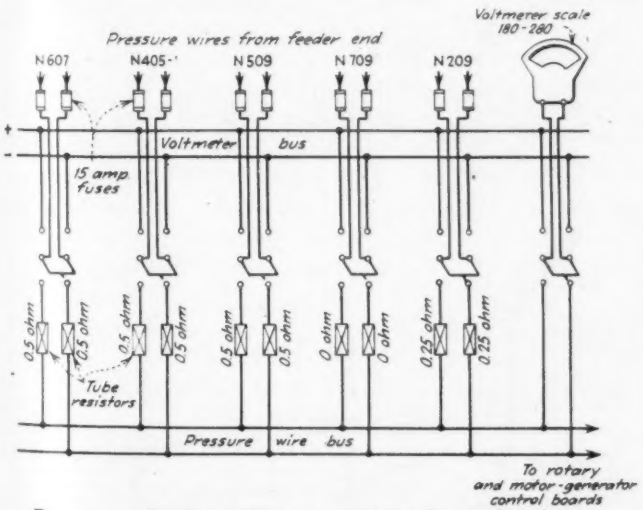
Average Feeder-End Pressure in Automatic Stations

By OSCAR J. ROTTY
Superintendent of Substations
Union Electric Light & Power Company, St. Louis, Mo.

General practice in Edison substations has been to regulate voltage for a selected representative point in the system. In an automatic station where frequent end-pressure readings cannot be taken and where the voltage control cannot be changed from one pressure point to another that scheme might result in poor service. This



Pressure wire bus gives average feeder-end voltages and operates voltage-regulating relays

difficulty is overcome in the d.c. substations at St. Louis by establishing in each substation what is known as a "pressure-wire bus." To this bus are connected the feeder and pressure wires which are brought into the station from six or eight representative points in the area supplied by the station. By using resistors to make all pressure wires of the same equivalent length a feeder-end pressure which is a true average is obtained and used for operating the voltage-regulating relays. This makes the station responsive to abnormal voltage conditions at any point in the system as well as producing "flat" feeder-end voltage at all values of load.

▼

Dealer Competes for Appliance Sales and Gets His Share

By A. T. KUNZ
El Paso Electric Company, El Paso, Tex.

Like other contractor-dealers, the Reynolds Electric Company, El Paso, Tex., felt the effect of central-station merchandising. But unlike many others, the Reynolds Electric Company did something about it. Lou J. Reynolds, manager of the firm, knew about the "district representative" plan used by the El Paso Electric Company and knew that it had worked. Why couldn't he use a similar method? He could and he did. One result that appeared in the second week of trial of the

Net Sales from "Mazda Lamp Man" Campaign

Period.	Lamps	Appliance
May 15-30	$170.00	$48.60
June	340.76	132.79
July	623.02	146.23
August 1-15	703.24	260.00
Totals to August 15	$1 837.02	$587.62

plan was that lamp sales rose from an annual rate of $720 to $8,840. That is, lamp sales in 1929 totaled $3,700; in March, 1932, they had dwindled to $60 per month, but $170 worth of lamps were sold in the first two weeks of the plan. Lamp sales are quoted as evidence of the success of the method because lamps are the means by which the Reynolds Electric Company decided to reach its customers—the "Mazda" lamp man. Results of the plan are shown in the accompanying tabulation.

There are six of these men, neatly uniformed and bonded, who work under a supervisor. Besides the six lamp salesmen and supervisor, two extra electricians have been employed to handle small appliance repairs and install convenience outlets. These two men have worked steadily, averaging six hours daily, since the plan was put in operation.

Service to the customer is the reason for the plan's instant success. Each salesman's equipment includes a screwdriver and a knife, for making minor repairs to attachment plugs. Such repairs are made without cost. The salesmen also carry cheesecloths for cleaning shades and reflectors when they make lamp replacements. A neat leather carrier has been provided for each salesman containing a stock of goods valued at $26. This includes such items as lamps, fuses, attachment plugs and iron cords. The salesmen also carry a full supply of introductory cards, catalogs, price lists and descriptive pamphlets covering items offered for sale.

This sales plan is a sure way past the front door of the average home and, through stressing service to the customer, it has been possible to pave the way to a more ready acceptance of electric appliances of all kinds.

115-Kv. Oil-Filled Cable Under Columbia River

By E. F. PEARSON,[1] G. B. SHANKLIN,[2] W. R. BULLARD[3] and S. B. CLARK[1]

A SUBMARINE crossing embodying three 115-kv., single-conductor, oil-filled cables has been in operation on the bed of the Columbia River near Portland, Ore., since June 19. Two separate crossings were involved because of Hayden Island, which divides the river into two channels at this point. The longer crossing is 3,460 ft., while the shorter is 1,360 ft. This crossing forms a link in the 36-mile 110-kv. (nominal) transmission circuit from the new Ariel hydro plant of the Inland Power & Light Company to the load center of the Northwestern Electric Company in Portland.

Some of the important features are illustrated. Among topics* which will be discussed are: (1) Reasons for using a submarine crossing (vs. overhead), laying cable directly on the river bottom (vs. trenching), selecting oil-filled cable (vs. solid); (2) features of cable (including carrying capacity), terminal structures, anchorages, bonding and grounding, lightning protection, oil-level alarm and maintenance of oil pressure; (3) methods of installing the cable.

Cost comparisons between crossing the river overhead or submarine clearly established the economy of the latter method. Factors contributing to this decision were: The 198-ft. minimum clearance above low-water requirements; the flat terrain at the crossing site and in the vicinity; the small increment cost for a double-circuit overhead crossing over a single circuit, making construction for two circuits the logical procedure, although only one was needed initially, and the unusual mechanical strength requirements for the overhead construction on account of the occasional very severe ice-loading conditions experienced.

Thorough consideration was given to the idea of trenching cables in the river bottom to protect them from ship anchors and other external damage. With the present river bottom at elevation minus 28 ft. (low water = 0) it was decided that a trench would have to be excavated to elevation minus 40 ft. in order to be beneath any future ship channel bed and out of reach of projecting anchor and dredge cutter heads. Such a trench constructed 7 ft. wide on the bottom with walls of 1:3 slope for withstanding river current would cost from $40,000 to $50,000. There was no definite assurance that a trench at right angles to the current could be kept open during laying without additional expenditures for sheet piling or for removing extra sand yardage.

With cables covered at this depth it is believed that it would be economically impractical to salvage the cable in case defects developed. Then it would necessitate the abandonment of the cable and writing off of a comparatively large investment. With oil-filled cable laid directly on the bed of the river the cable can be readily lifted and repaired in case a fault develops.

[1] *Northwestern Electric Company.* [2] *General Electric Company.* [3] *Electric Bond & Share Company.*

**From A.I.E.E. paper presented at Baltimore, October 10.*

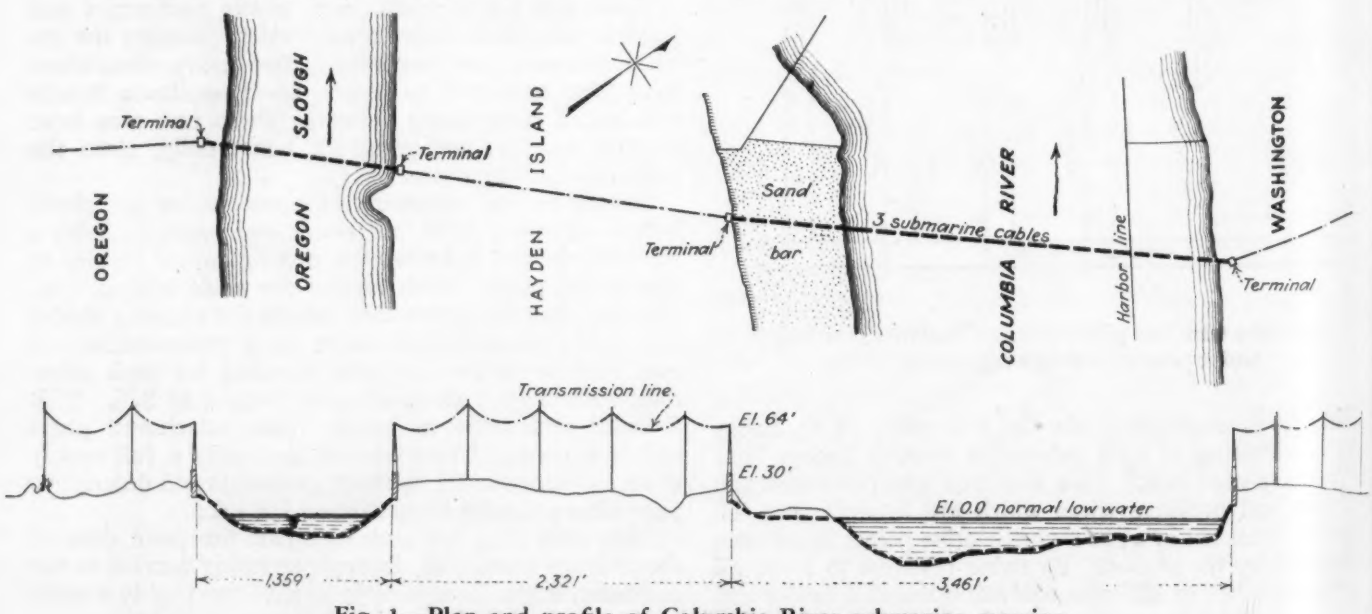


Fig. 1—Plan and profile of Columbia River submarine crossing

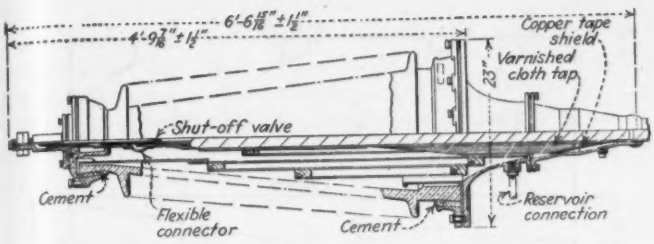


Fig. 2—One of the 132-kv. terminals for oil-filled cable

The repair joints, held in stock for emergency use, are of standard design successfully used in previous conduit installation with the exception that the spun copper casing is protected by a cylindrical "Everdur" armor box, having bolted armor clamps at each end. The halved connector is of the double shut-off plug design that has proved so successful in the past.

The Northwestern Electric Company has an experience record of 92 submarine cable years covering eleven three-phase, 11,000-volt submarine cables laid directly on the beds of the Columbia and Willamette Rivers in the general vicinity of the new crossing. This experience record, excluding pothead failures, discloses only one failure. In that case failure occurred when cable was accidentally picked up by a sand digger clamshell. This favorable experience record, combined with greater accessibility and less chance of abandonment, and fixed charge savings of from $5,200 to $6,500 per year were responsible for the decision to lay the cable directly on the bed of the river.

Decision to specify oil-filled cable was based on the following facts:

1. Most favorable operating records of oil-filled cable over the past four years, particularly when compared with solid type cable operating at high voltage.
2. High electrical endurance strength of oil-filled cable as demonstrated in laboratory and field tests.
3. Ability of the latter type of cable to maintain perfect impregnation and prevent void formation and ionization.
4. Development of a satisfactory joint for oil-filled type submarine cable.

Three cables were laid directly on the bed of the river 4 ft. apart and the shore ends above extreme low water were trenched in and covered with 4 ft. of sand. Some slack in the shore ends was provided for use in case of channel changes by the scouring action of the river or by dredging operations.

The hollow-core, single-conductor, oil-filled cable had the following specifications and calculated dimensions:

Inside diameter of copper supporting spiral, 0.690 in.
Inside diameter of conductor strands, 0.790 in.
Outside diameter of conductor strands, 1.277 in.
Conductor cross-section, 750,000 circ.mil.
Thickness of wood pulp paper insulation, 0.560 in. (nominal).
Perforated copper shielding tape (0.005 in.) interlocked with one paper tape.
Inside diameter of lead sheath, 2.497 in.
Outside diameter of lead sheath, 2.810 in.
Lead sheath $\frac{5}{32}$ in. 2 per cent tin-lead alloy.
Two layers 16/3 ply tarred jute and asphalt.
Hard-drawn copper wire armor (0.238 in. diameter).
One layer 16/3 ply tarred jute, asphalt and whiting.
Over-all diameter, 3.80 in.
Weight, 20 lb. per foot.
Voltage rating, 115 kv., three-phase, grounded neutral.

Seven reel lengths were manufactured and each length included not only the amount required for installation but also additional cable for test purposes. As manufactured, three lengths were approximately 3,780 ft. each, three more were approximately 1,600 ft. and the remaining 832-ft. length was shipped on a separate reel, to be held in reserve for possible future emergency repair work.

Great care† was exercised in drying and impregnating the cables, maintaining the proper oil pressure in them at all times, avoiding gas occlusion and testing complete cables and sample lengths.

After test each of the seven shipping lengths was placed on a separate reel, in the body of which was mounted a sufficient number of cell type pressure reservoir units to maintain an oil pressure between 5.1 lb. and 15.0 lb. during shipment and installation. Each reel was axially mounted in a permanent cradle with band brakes for unreeling cable. Due to excessive size and shipping weight it was necessary to use special gondola freight cars and load only one reel per car.

Carrying Capacity of Cable—The carrying capacity of a submarine cable is determined by the thermal conditions at the shore ends, the temperature rise of immersed sections being much less. Due to transfer of

†*Covered in detail in A.I.E.E. paper at Baltimore.*

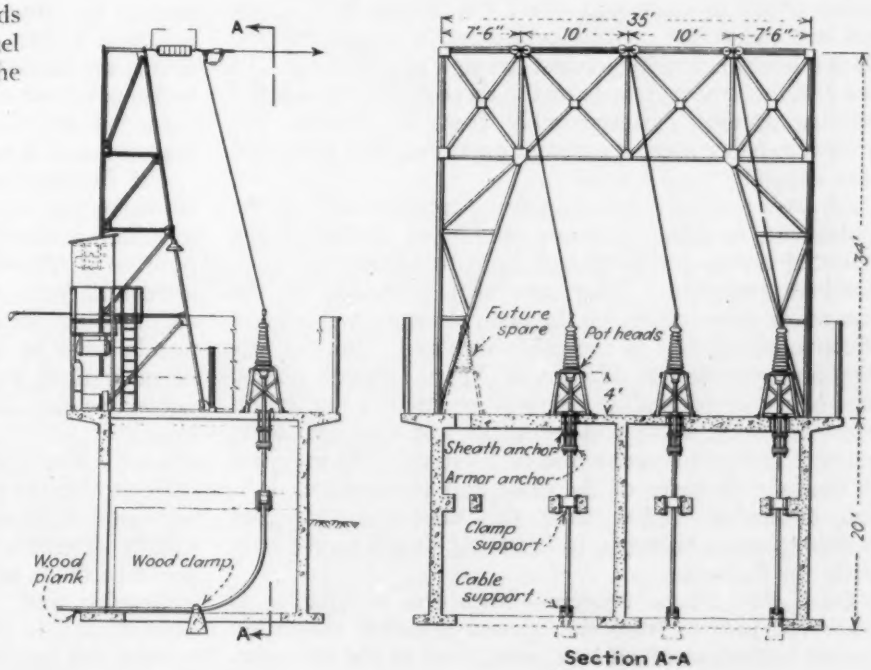


Fig. 3—Features of terminal structure

The outdoor potheads were rated at 132 kv. and have guaranteed dry and wet 60-cycle flashovers of 375 kv. and 280 kv. respectively. The terminal lugs had a flexible type stud to allow limited movement of cable conductor during expansion and contraction. A special shut-off valve in the stud permits oil pressure to be maintained in cable core while vacuum treating and filling terminal with degasified oil after assembly.

On account of the fog and contamination condition existing along the river, a leakage distance of 80 in., equivalent to 1.2 per kv. to ground, is provided on the terminal bushings. Two strings in yoke, each of seven suspension units giving leakage distance of approximately 90 in., are used on the dead ends. No pedestal insulators are required with the simple structure design employed.

heat from these exposed vertical risers into the earth the usual formulas for cable in air do not exactly apply and the thermal correction factor was checked by heat run after installation. On the basis of an ambient air temperature of 40.5 deg. C. this cable has a conservative rating of 575 amp. for maximum conductor temperature of 70 deg. C. at vertical risers and with copper armor bonded at base of terminals. If steel armor had been used under the same conditions the rating would have been only 430 amp., due to excessive armor and sheath losses.

Design of field installation

Terminal Structures—The terminal structures, four in number, consist of reinforced concrete bases and platforms, supporting cable terminals and accessories and steel dead-end structures for the overhead lines (see Fig. 3). The deck of each structure is surrounded by a barrier of steel plate to protect the potheads and accessories from bullets of youthful sportsmen. Jetties or dykes for protection against undercutting and damage by floating objects during flood periods can be provided for the structures on both sides of the main river channel when necessary. The steel dead-end overhead structures are mounted on the decks of the concrete terminal structures.

Cable Anchorage—Anchoring of the cables is accomplished by chains attached to two concrete dead-men at each terminal structure. Attachment to the cables is made by means of basket grips, these being considered sufficient because a considerable section of cable between the structures and the water's edge is buried in the sandy river bank, which will take up a considerable amount of pulling tension.

Bonding and Grounding—During operation the armor carries a current almost as great as that in the conductor. There should be very little corrosion due to electrolysis as the water has a comparatively high sulphate content. If electrolysis does tend to start the lead sheath soon becomes coated with a tough, permanent film of lead sulphate, thus automatically stopping the action. However, since with copper armor any corrosion which might occur would affect the anodic lead sheath and not the armor, it was considered advisable to take all possible precautions against damage by corrosion. To this end the armor strands of the three cables are bonded together at each end separately from the sheaths, the latter also being bonded together separately and grounded (see Fig. 4).

Lightning Protection—Lightning protection for the cables and terminals consists simply of spillway gaps mounted across the dead-end insulator strings at each terminal structure. They are well grounded to the grounding network, which, in turn, provides a short and effective connection to the cable sheaths. The gap setting for operation at 115 kv. is 30 in. between points, this being considerably below the impulse insulation strength of the cable and terminals and also somewhat below the maximum recommended setting of 36 in. given by the manufacturer of the cable and accessories. It is also somewhat higher than the maximum expected switching surge voltages, so lightning should be the only cause for flashover.

Oil Level Alarm System—Since the installation is somewhat remote from the nearest attended substation remote indication of oil level conditions in the oil reservoirs was provided. By a system of resistances, individual indication of different reservoirs can be given over a single telephone line, on an ammeter type of indicator.

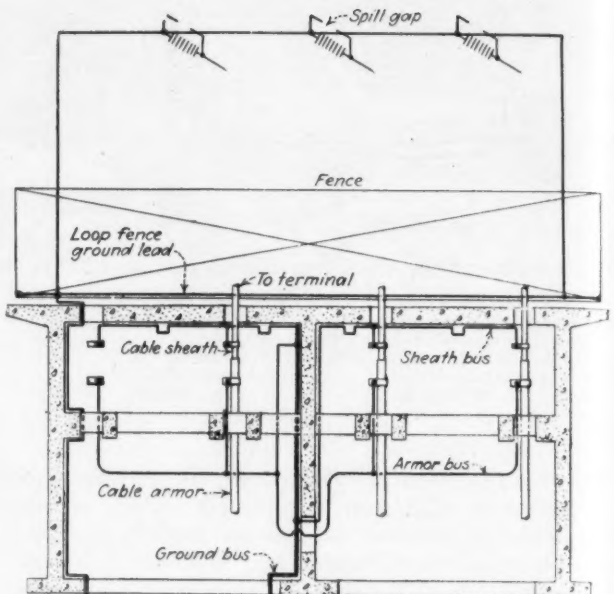


Fig. 4—Bonding and ground arrangement at terminals

The two sets of bonds are connected by a removable jumper, both armor and sheath being grounded when this jumper is in place. This arrangement permits periodically inserting an ammeter between the armor and sheath and testing for electrolysis currents. If appreciable currents should develop the sheath and the armor can then be separated by removing the jumper or they can be connected through a battery supplying a potential counter to the electrolysis potential. The ground electrodes consist of a series of driven rods interconnected with each other and with all equipment and structures, forming a low resistance grounding network.

Emergency Oil Supply—In case of cable damage resulting in an oil leak, as for instance by ship's anchor, considerable time might elapse before the cable can be raised and the damage repaired. Hence emergency oil storage was provided so that continuous oil flow can be maintained until repairs can be effected. Two 50-gal. drums are stationed at each terminal structure with connections to the cable oil system. Nitrogen under pressure, but not normally in contact with the oil, affords the means of transporting the oil.

Oil Pressure and Flow Characteristics—During installation and also when the cable ends were opened for terminal assembly great care was taken to maintain positive oil pressure at all times as a safeguard against accidental leakage. In the case of submarine cable the surrounding water pressure at different points of the profile must be considered. Positive oil pressure must be maintained at middle of cable length during coldest winter weather, without exceeding a safe oil pressure on sheath at low-water level under full-load summer conditions. The Columbia River crossing was particularly difficult because of the great difference (33 ft.) between low- and high-water levels. The maximum depth in middle of channel at low water level is 30 ft., giving a depth of 66 ft. at high water.

Gravity feed (type CC) reservoirs mounted at the same level (44 ft. above low water) at both ends feed toward the middle of the cable length. They produce

an oil pressure of 18 lb. per square inch on the sheath at low water level. Only 1 or 2 lb. margin of oil pressure over water pressure is left at the middle of the length when load is dropped in the winter at high-water level. However, this margin is sufficient, since the assumed conditions are extreme and of only transient nature, pressure drop in cable core lasting for less than an hour after load is dropped.

These limiting conditions and the need of utilizing all available oil pressure did not allow the use of restrictors for limiting oil flow in hot weather in case of accident. This question was given careful study. Briefly summarized, the conclusions are:

(a) The regular switch signal or the oil level alarm relays will give warning immediately or soon after the accident, allowing an emergency crew to be on the scene within one or two hours.

(b) The position of the failure, and other factors, will determine whether the reservoirs involved are exhausted of oil by that time. If not, the emergency oil supply is turned on and the nitrogen gas pressure adjusted (20 lb. limit) to maintain an oil flow not greater than 6 gal. per hour. This will entirely prevent entrance of water or air in the system and the flow can be maintained until the damage is located and repaired.

(c) Even if one or more reservoirs are found exhausted the water will enter the cable core very slowly, if at all, and will have traveled only a short distance by time crew arrives. Emergency oil flow will then be adjusted as described, the oil leak located and the cable picked up, not at point of leakage, but 200 ft. on each side. It will be cut under oil flow at these points and tested for moisture, repeating the operation in 100 ft. steps if necessary. A length of replacement cable will then be spliced in.

The importance of this installation, the unusually great size of the reels of cable and the fact that this was the first submarine installation of oil-filled cable to be made in this country set a task of a new order for the construction forces.

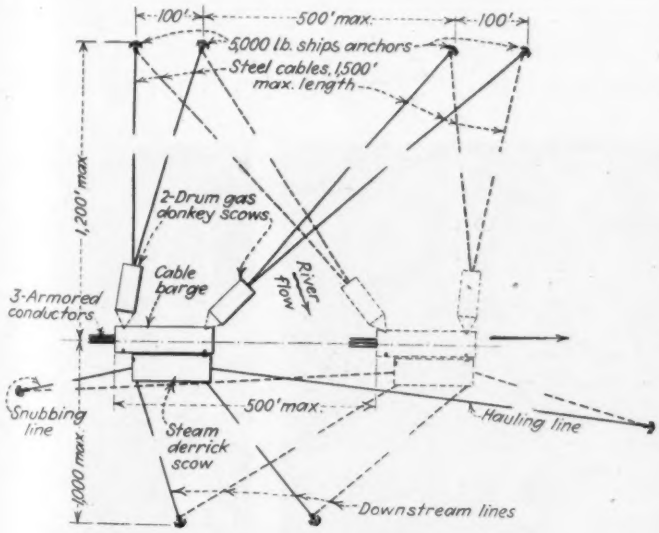


Fig. 5—Arrangement of cable-laying equipment

A donkey scow was placed at the bow and stern on the upstream side of the cable barge. Two steel lines with large anchors attached from each of the donkey scows were maintained upstream while laying and moved in successive steps across the river. The derrick barge was held alongside the main barge on the downstream side, with steel lines from the donkey drums, also with anchors attached, from bow and stern for control of movement across the river. These anchors were also moved as required. The derrick tugs were used for changing anchors and to clear lines of driftwood, trees, etc., which were quite heavy at this flood stage of the river.

Buzzer and bell signals were provided to each operation control point. One control was from the point where cable went overboard, controlling slack and real movement; another point controlled barge movement across river and the upstream anchor lines from the donkey scows. This control point was in turn controlled by telephone from the shore, where men with transits were located for alignment of the cable across the river.

Several weeks before the installation was started a school was set up for the construction personnel and intensive training, including the making of pothead connections, was conducted.

Equipment for laying the long, heavy lengths of submarine cable (see Fig. 5) included a 400-ton flat-decked barge 125 ft. long, 32 ft. wide, on which the three cable reels for each crossing and control equipment were placed. As an auxiliary to the cable barge, a steam dipper dredge barge was utilized as a derrick. In addition there were two small gasoline donkey scows from the Port of Portland's dredging equipment, a spare flat-deck barge for use as spare deck space and two small derrick tugs, one for use in changing anchor lines and anchors and one for emergency.

The main barge was arranged for laying the three cables at each crossing simultaneously, the reels being mounted in tandem. The two reels nearest the laying end, or stern of the barge, were raised sufficiently to allow the cable from the reel forward to pass underneath. Easy-running rollers were placed to reduce all possible friction. An overhanging timber structure at the stern of the main barge had rollers arranged for a minimum safe bending radii of cable as it was fed overboard and spaced the cables 4 ft. apart. The two flanges of each reel were equipped with friction band brakes, one used for laying control and one for emergency.

The shorter sections of cable across the Oregon Slough were laid first and on a rapidly rising river. The three shore ends, one at a time, were pulled over rollers, located at frequent intervals, into No. 4 terminal structure by means of lines from derrick-hoisting drums, fastened to the armor pulling eyes at the cable ends. Cables were clamped in final position, with necessary slack above terminal pedestals for terminal installation.

Temporary oil connections were made between the three cable ends and the three permanent oil pipings which had been installed with permanent oil reservoirs, emergency oil tanks, etc., previous to cable-laying operations. Oil supply to the cable was made from the permanent oil supply apparatus, oil supply to the cable from the temporary pressure reservoirs shipped with the reels being closed off. Reserve supply of oil and the degasifying equipment were connected and made ready to provide against any possible emergency that might arise. After all connections were complete, short slacks were laid just outside terminal No. 4 and temporarily anchored, and the laying of the Oregon Slough crossing started. This laying to a point approximately 300 ft. from terminal No. 3 (Fig. 1), where slack was to be dropped, took five hours.

Slack was laid out on the deck of the spare barge, lashed in place to cross timbers which were later raised with a derrick, and the spare scow pulled from under the suspended cables. The suspended cables were then carefully lowered to the bottom of the river, later checked as to lay by a diver, and then the lashing cut, allowing timbers to float to the surface of the river. The laying equipment was then moved to terminal No. 3 and clamped into proper place. The three cables were then, one at a time, moved over toward the edge of the barge and carefully lowered overboard to final location alongside.

Laying of the three longer sections across the main channel (Fig. 5) was more difficult, on account of the extreme high water and heavy current, but was accomplished in the same manner as the Oregon Slough crossing. Laying of these lengths was started from structure No. 1 on the Washington side of the river and laid to terminal No. 2. The crossing time of the river proper was approximately fourteen hours, the following two days being used in disposing of slack at the outer edge of the 800-ft. sand-bar and working the barge equipment through the dredge channel to structure No. 2.

The same preparations were made at No. 1, where cable ends were first temporarily connected to the permanent oil reservoir system for any oil emergency condition, as were made at No. 4.

When about 1,000 ft. from structure No. 1 the oil pipe connection between the inner end of the cable and oil reservoirs contained within the reel body was sheared off on account of creepage movement of the inner layers of cable. The man handling the emergency oil apparatus at structure No. 1 immediately noticed a drop in oil pressure and, as per instructions, supplied the emergency oil, maintaining the established pressure. Before the crossing of the main channel was complete the oil connections on the two remaining cables were also sheared off, due to the same cause. The leaks thus developed could not be closed off until sufficient cable was taken from the reels to allow access to the inner layer.

After the cable laying was completed terminal pothead installation was immediately started at terminal No. 3, the necessary oil flow from cut cable ends being supplied from the permanent oil system through the temporary oil piping at terminal structure No. 4. No difficulty was experienced at any time during installation. The entire structure was temporarily covered with canvas to protect the working deck from rain and, in turn, each terminal location was inclosed with a special tent during taping and terminal-assembling operations.

Terminals were next installed at terminal structure No. 4 with oil control for operations at this point through the cable from the permanent oil system at No. 3. The same procedure was followed for the terminal installation at structures Nos. 2 and 1. In all terminal assembly operations, as well as at other times, telephone communications were maintained between all four structures. This communication between structures allowed very close regulation of required oil flow and pressure during terminal installation and also for the final adjustment and testing of the entire oil system.

Aside from the broken oil connection, no difficulty of any serious nature was experienced during the entire installation of cable and terminals.

As soon as the installation was completed a three-phase, 60-cycle short-circuit current heat run was made, temperatures, induced sheath and armor currents, oil volume changes, etc., being carefully measured. This heat run served a twofold purpose—it caused uniform dispersion and absorption of any small amounts of impurities that might not have been excluded and it furnished a final check on all theoretical calculations.

▼ ▼ ▼

Garden Floodlighting Inexpensive and Simple to Install

The accompanying night view shows the sunken rock garden and pool on the estate of Mrs. Herbert Bradley, Upper Mountain Avenue, Montclair, N. J. This garden was a prize winner in last year's *Herald Tribune* garden contest. The owner realized that many of her friends would have an opportunity of enjoying the beauties of this spot only after the sun had set and therefore she provided means of revealing its charms at night.

The illustration at the right shows how a projector can be placed so that it is out of the way and inconspicuous. Mounted beneath the overhanging eaves at the edge of the upper porch (to make relamping convenient) is a G.E. type L-1 floodlight with lightly stippled lens and 500-watt "Mazda" lamp. By properly focussing and directing this unit the garden as a whole is lighted, with more intense illumination concentrated on the pool.

The Competitive Power Situation

By ELY C. HUTCHINSON

Editor "Power"

Competition increasing because of discharged engineers, technological progress, relatively higher utility investment values and sales aggressiveness of manufacturers. Economies should govern.

TO THE extent that utility or isolated power fails to recognize and abide by the economics of power generation, each will find its house is built upon sand.

The many beneficial results and almost instant success of centralized power is proof that it was needed. Its subsequent growth and the development of its technology are among the finest records of a generation. In the sweep of progress several things of economic influence happened:

1. Many of the old time isolated plants, unable to compete with the new order, were closed out.

2. A sense of competition, even animus, grew out of this situation until the old-time operating man came to regard the central plant as a natural enemy.

3. Simultaneously, consulting engineers began applying to the isolated plant the improvements mostly initiated by the central stations.

4. Meanwhile the central stations, under protection of state regulation and the established right to earn a reasonable return on capital investment, extended their operations by means of long transmission and interconnections to include outlying districts. These operations were not always economically justified. It should be noted, however, that in this the central stations were not always the aggressors, but acted under pressure, and at times even under compulsion. But the result economically was the same.

5. Gradually the spread of territory came, in many cases, to the definite point of diminishing returns. Where this has happened the central stations have encountered a stiffened competition from isolated power plants.

6. Other limitations to load growth come from large industrial establishments which in themselves form a power concentration that economically permits them to set up plants, wherewith to generate power on their own account and save to themselves the business profit otherwise necessary to pay the central stations.

7. Leaving aside the question of public ownership and private ownership, there do exist cases where isolated municipal plants are economically justified in remote communities, although these same communities may, upon further growth, economically justify connection into central system networks.

8. There are cases, even in the heart of territory served by central power, where conditions of load and variety of power services economically justify isolated plants as long as present rates for power prevail.

These, then, are some of the factors which postulate the situation prior to the start of the new phase commencing in the fall of 1929.

About the year 1920 the zenith in number of municipal installations was reached and a decline then set in. This was due in part to improved technology and more favorable rates in the field of central power generation and distribution, and also to the business policy of the public utilities interested. In a large number of cases, however, the basic economics of power production, sometimes with other influences, has prevailed to keep the municipal plant in business. Where this is the case, those plants remaining have increased their output, so that there has been an ever-mounting growth of horsepower generated despite the decrease in plant numbers.

From 1920 to 1925 the drop in number of municipal power plants was comparatively rapid. The rate has tapered off, however, during the years 1925 to 1930.

Throughout the process there has been evidenced an increasing popularity of Diesel engines and steam turbines as prime movers. There is a prevailing idea among utilities that Diesel engines are primarily responsible for the improved economy of municipal plants. This has, in fact, grown to the point where the Diesel has come to symbolize to the utilities all that is undesirable in municipal plant competition. Yet the steam turbine figures more prominently in the growth of municipal plant output than does the oil engine. Why, then, do many utilities indulge in the luxury of damning the Diesel to the point where they even refuse to use it, while permitting the steam turbine to go free of a similar curse? Obviously, there is no sound economic reason in one case any more than the other. This is no way to meet the competition of the Diesel engine. The only way is to use it yourselves, when sound engineering demands.

Opposition to municipal power plants on the economic ground of public versus private ownership is a clear-cut issue, but there is no doubt that the policy of some of the utilities has been instrumental in increasing the difficulties of their industry in this controversy.

EDITORIAL NOTE—This article presents many points of view and arguments with which the editors of ELECTRICAL WORLD disagree, but it is a constructive endeavor of the author to present his case. It is published because it contains the points and arguments that power salesmen must encounter in selling central-station business.

**Abstract of paper presented at the Pennsylvania Electric Association.*

There are plain cases where municipal plants are the direct result of mistaken central-station policy.

Municipalities have also been helped by the sales policies of some of the manufacturers. I refer to those who have financed municipal undertakings by agreeing to put in the plant and receive their pay from the savings effected by the new installation. While from the utility viewpoint this may seem terrible, it must not be forgotten that the economics of power supply is at the bottom of it if it is sound. It is the difference between the cost of making your own power and buying it that pays the purchase price of the equipment. True, the question of public or private ownership is involved. But it is not the whole answer. The wide open mind must come to this conclusion.

Present signs point to increased activity in the construction of municipal power plants by reason of the relatively high credit of municipalities and the tax-free feature of their bonds. No less than nine cases of recent purchase, some for additions to plant and some new, have come to my attention in the last 30 days.

Isolated industrial plant

It has been evident for a good many years that central-station power, despite a phenomenal growth, has gained little if any on the normal economic progress of isolated power. That is to say, that while utility power output has grown greatly there has been no reduction of industrial power to coincide. There are numerous reasons for this and the reasons themselves change from time to time.

About 1916 the curve of isolated power production, as indicated by sales of electric motors to industrials operating on their own power, took a decided upward turn. It has maintained this direction ever since. Latest census reports show a steady growth in motors driven by industrially generated power from 6,968,950 hp. in 1919 to 12,376,376 in 1929.

One reason for this lies largely in the amalgamation of industries into larger units, which in themselves possessed all the characteristics necessary to the economical production of their own power. Frequently they are large users of process steam, to which power generation is a logical by-product. Such organizations are large enough to employ their own engineering staffs and are managed by executives educated to make unprecedented decisions based upon logically assembled facts. The technology involved is largely the product of central-station development itself.

Given the capital, brains, equipment and the use for it, large industrials can make power as cheaply (or very nearly so) as many utilities and can distribute it to themselves for less than the power company can. What economic ground is there, then, for buying it?

All through this period it should not be overlooked that utility-trained men have been available to help industry—these men themselves being released as a result of economic changes within the utilities, such as amalgamations, mergers, centralized engineering operations of holding companies, and the like.

What the larger industries are doing is true also of the smaller ones, albeit on a lesser scale. The same thing is true of isolated plant operation in hotels and office buildings, hospitals, public buildings and other institutions requiring heat and power. Of course, each case is individual and requires special analysis. But through it all, "old man economics" will surely prevail.

Under the present conditions—that is to say, since the fall of 1929—things have happened to strengthen greatly the favorable position of isolated power production.

A vast number of exceptionally competent engineers have lost their positions with the utilities. These men must live. They know one thing better than any other, and that is how to design and operate power plants economically. What is more natural than that they should seek a market for their talents among the isolated plants, large and small, which will benefit thereby? This is exactly what is happening. Specific instances are almost of weekly occurrence. Some of the projects are very large, some are cases where utility men are now engaged in designing municipal projects, others have to do with modernization of existing plants to reduce the cost of power generation.

There is also a wide increase of interest in isolated plants to supply power for coal mines. New circumstances in connection with the production and marketing of coal have brought about a decided change of the coal operator's viewpoint in respect to his power requirements:

1. The grading of coal as required for the present-day market makes it necessary for the mines to reject a considerable quantity of fuel not up to present-day market specification, but which, if burned in a plant at the mine, would not be wasted.

2. Hoisting loads raise the peak demand of purchased power so high as to make the cost an inordinately large percentage of the total cost of production. An average approximation for the cost of power to the total cost of production is 13 per cent. Isolated power plant engines are in prospect which will overcome the difficulties of speed regulation on such fluctuations of load, by providing the necessary additional WR^2 with flywheel.

3. Buying practices of some of the utilities which have forced coal producers to give a cut or brokerage to utility-owned distributing companies have left a bad taste and made it even more necessary for the coal miners to find some way of reducing their cost of production.

Mining companies do not have to put in expensive plants nor the most efficient ones. Fool-proofness and reliability, together with low first cost, are the specifications. Simple non-condensing equipment is entirely practicable in many cases. The available fuel which would otherwise be complete waste is generally far in excess of the fuel needs, even when operating efficiencies are quite low.

Manufacturers aid competition

Manufacturers of power plant machinery have not been slow to recognize that the falling off of central-station load during the late depression has decreased the normal likelihood of much new business from that source for some time. They have consequently turned their attention to the more immediately promising field—the isolated plant.

New equipment and new ideas to make the small plant better are rapidly coming into the market. This can have only one result, the improved position of the isolated plant as a power producer.

Another factor of influence in the same direction is the government tax on electricity. While this does not

apply to electricity furnished for industrial purposes, its application to lighting and commercial usage may be expected to increase the resistance to the purchase of power where it may be made for about the same price.

Up to the present, there are comparatively few cases where utility and isolated power plants—municipal, industrial or institutional—are doing a co-operative job. But where they are, most examples have fully satisfied expectations on both sides.

There are other cases, not in the co-operative class, where, if economy were the only deciding factor, the utility would not receive the contract. Then, again, there are instances where industries have been eminently successful in making good contracts by preparing to make their own power and allowing evidence of this intention to become known to the utilities. There are also occasions where stiff-necked opposition to utility power has resulted in isolated plants being built where the economies were not sound.

Through it all, one who sees both sides cannot fail to recognize executive efforts to inject some decidedly uneconomic and at times even coercive policies into situations which, in my opinion, would be different were there a wholesome recognition of the fact that isolated plants cannot be made to succumb to any other than "old man economics."

Each case is a separate study, to be made by engineers on each side with only the highest ideals in mind. Each should be determined to arrive at the facts, and when these are found the decision will be automatically made, on its merit.

Isolated power today has as good professional engineers at its command as most utilities, because many have been utility trained. Manufacturers of power equipment, faced with a period where new utility business will not support them, are turning to isolated plant equipment to keep their factories going. Nothing necessary to economical steam and power generation is denied the isolated plant today.

Conditions in the way of financing, availability of graded fuels, high-pressure boilers, extraction type turbines with favorable steam rates, automatic control and operating devices, and so on, were never so propitious. The whole situation, from the utility viewpoint, demands a fresh consideration of major policies.

Polar Chart Makes Vector Addition Easy

By G. H. ARAPAKIS

Assistant Engineer Transmission and Distribution, New York Edison Company, New York

A new chart eliminates the use of trigonometric tables and reduces the time required for the addition and subtraction of vectors. With the chart shown in the accompanying figure two polar vectors can be added or subtracted and the result obtained in the polar form by entering the chart only once. The principle of this chart is the paralleogram law of composition of vectors, with the vectors referred to a unit basis. The larger vector is taken as a unit reference vector, represented on the chart by 00′. The smaller vector is expressed as a ratio of the larger vector and is laid off on the chart from 0′, at an angle which is equal to the angular displacement between the two vectors.

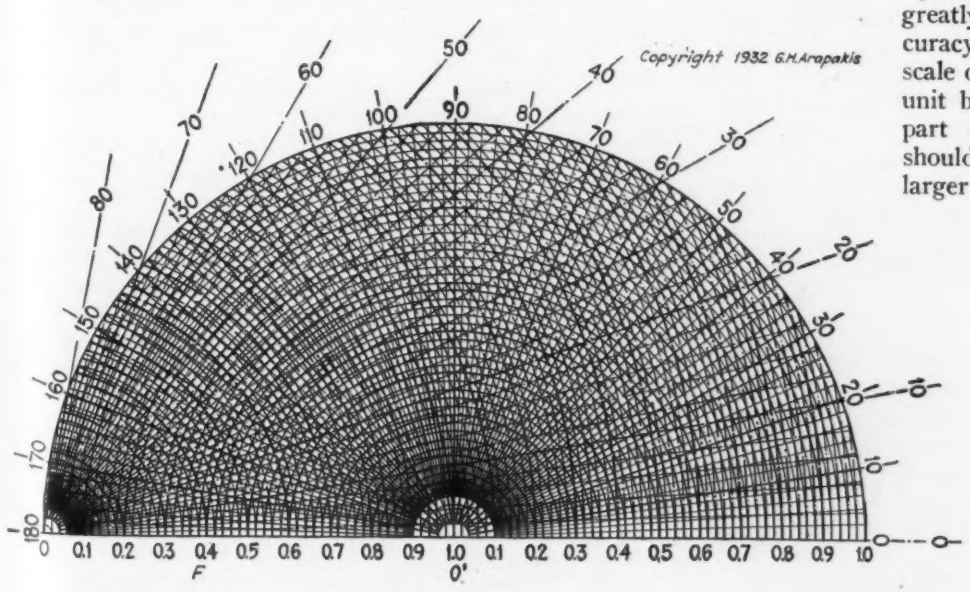
For example, if it is required to add two vectors $V_1 \varepsilon^{j\theta_1} + V_2 \varepsilon^{j\theta_2} = V_0 \varepsilon^{j\theta_0}$ where $V_1 > V_2$, the chart is entered with the ratio of $\frac{V_2}{V_1}$ on the solid line circles about 0′ and the angle $\theta_1 - \theta_2$ on the solid angle lines from the same point. On the dot and dash lines and circles from 0, read the angle θ and the ratio k, respectively. Then

$$V_0 = KV_1, \text{ and } \theta_0 = \theta_1 + \theta$$

The angle θ is always added to, or subtracted from, the angle of the larger vector with the plus sign if V_2 leads V_1 by < 180 and the minus sign if V_2 lags V_1 by < 180. The angular difference between the two vectors, disregarding the sign, will be either $(\theta_1 - \theta_2)$ or $360 - (\theta_1 - \theta_2)$. The chart should be entered with the angle which is less than 180 deg.

With a little practice, the time required to add or subtract two vectors in the polar form can be shortened considerably by means of this chart. In comparison with the ordinary method of using trigonometric tables the saving in time can be as much as 75 to 80 per cent.

Furthermore, the possibility for a numerical error is greatly reduced. For engineering accuracy the chart can be drawn to a scale of approximately 6-8 in. for the unit base vector line 00′), while the part of the chart about point 0 should be drawn to a somewhat larger scale.



Vectors may be added or subtracted on this chart

As a numerical example, let $V_1 = 125 \mid \underline{120°}$, $V_2 = 100 \mid \underline{130°}$. To find $V_1 + V_2$, enter chart with ratio of $\frac{100}{125}$ or 0.80 and an angle of 110° (i.e., 360°—250°). The ratio $k = 1.047$, angle $\theta = 46.0$ Therefore,

$V_0 = 1.047 \times 125 \mid 120° + 46.0°$
$= 131.0 \mid \underline{166.0°}$.

The angle θ is added, since the smaller vector leads the larger by < 180 deg.

Simplifying Adequate Service to the Home

By HARRY P. SPARKES
Manager Meter and Instrument Section
Westinghouse Electric & Manufacturing Company

SERVICE connections have long been the "bottleneck" curtailing the use of domestic electrical applications such as ranges, water heaters, etc. If, when service connections are made or changed, two other simple elements are incorporated in the house service numerous advantages may result to the customer, utility company, contractor, dealer and electrical manufacturer.

The co-ordinated plan which has been developed after seven years' study and experimentation by the Westinghouse Electric & Manufacturing Company considers service to the customer as a function and not merely as an assemblage of equipment, and does so with regard to the over-all cost of performing these functions. In general, the plan is intended to remove restrictions to increased use of electrical devices in old or new homes, even those occupied seasonally. It can be adapted to any form of construction now used and allows for future subdivision of circuits or metering. Cost of wiring is minimized, including permanent meter test facilities and leads to heavy loads. Provision of service is expedited. Complaint due to voltage drop is less likely to occur. Light as well as overload meter accuracy is provided, permitting load increases. Diversion of energy is greatly handicapped. Service can easily be disconnected. The customer is not inconvenienced by interruptions of service due to circuit-rupturing devices and the cost of restoring house service is eliminated. Repeated interruptions warn of necessary repairs or overloaded wiring. Hazards from short circuits are reduced. Meters are made readily accessible for reading and test without annoyance to the customer, thus reducing expense of delayed collections. Testing can be performed safely, easily, accurately and quickly. The scheme even permits the economies that can be derived from wholesale testing of meters in the field. Recording and analysis of meter history are simplified. By removing the "bottleneck" to increased usage markets are opened not only to appliance manufacturers, jobbers and dealers, but also to suppliers of production and service equipment, used from coal pile to customer's utilization.

How these benefits are obtainable will be discussed more in detail later.

Features of plan

The plan is based on accepted standards of the Edison Association of Illuminating Companies, the National Electric Light Association and National Electrical Code requirements for the new meter sequence connection. It involves standardization on three sizes of service entrance wires, three corresponding sizes of outdoor detachable meters,* use of ganged domestic branch circuit breakers† at the house load centers and portable stroboscopic testing.‡

With national standardization on 5-, 15- and 50-amp. meters having high registration accuracy from zero to 300 per cent of rated load, it is possible to co-ordinate services and meters with great economy as follows:

Load Range (Amp.)	Meter Rating (Amp.)	Size of Services	
		Conductors	Neutral
0–15	5	2 No. 6	No. 8
0–50	15	2 No. 4	No. 6
0–150	50	2 No. 2	No. 4

These three combinations of services and meters are adequate for serving all appliances now built for the home.

By terminating the service at an outdoor detachable meter adjacent to the load center (usually the kitchen), it is possible to place ganged domestic branch circuit breakers on the inside wall opposite the outdoor meter and minimize the length of connections therewith as well as the heavy leads to major loads. If desired, preassembled and prewired units, composed of a blanked outdoor meter receptacle and a short preformed conduit or flexible cable connected with the ganged breakers, can be provided ready for quick installation of the major elements involved. These units could be furnished by utilities to contractors after presentation of permits.

The plan is adaptable to old as well as new homes, including subdivided houses occupied by two or more tenants, as conduit or flexible cable can be run from the outdoor meters to the respective ganged load-center breakers.

The outdoor detachable meter and domestic breaker involved in the Westinghouse plan have been described before. The meter now provided has a virtually uniform accuracy,¶ from zero to 300 per cent of rated load, and is constructed and compensated so it is relatively tamper-and-diversion proof and unaffected by inclement weather or wide temperature changes.

Being plug-connected directly to the service wires and ahead of any circuit-rupturing or test devices, and because of its tamper-proof construction and location outdoors, exposed to public gaze, the meter minimizes any probability of power diversion. This has become an annoying factor and even a serious economic problem in some territories.

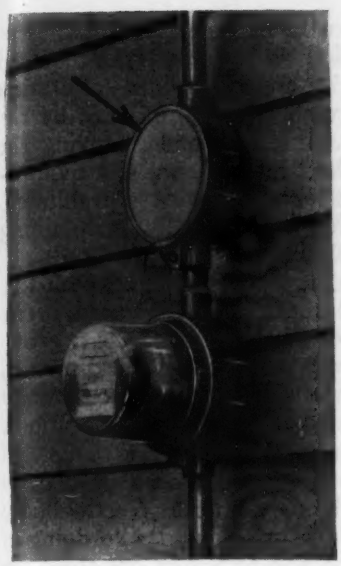
Since a portable testing jack carried by each tester can be inserted quickly and safely between the meter and its plug receptacle, there is no need for permanent test terminals at each meter. The permanent test facilities eliminated cost about $1.25 per installation, so that in a

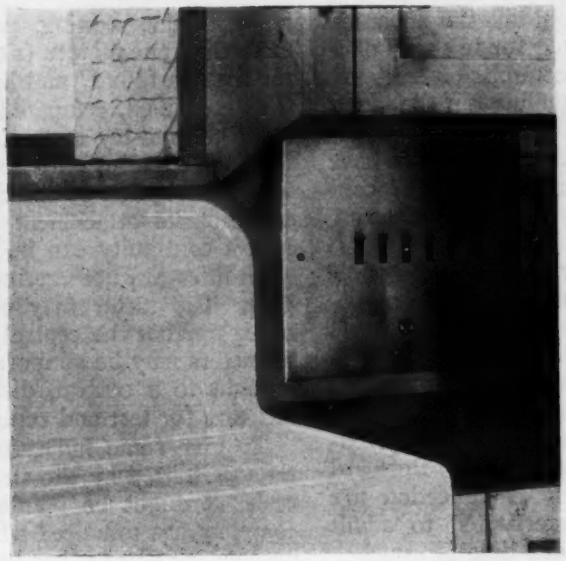
*"Electrical World," February 9, 1929, page 296.

†"Electrical World," February 7, 1931, page 287.

‡A.I.E.E. journal, Electrical Engineering, February, 1927, page 405.

¶See "Electrical World," December 20, 1930, page 1127.





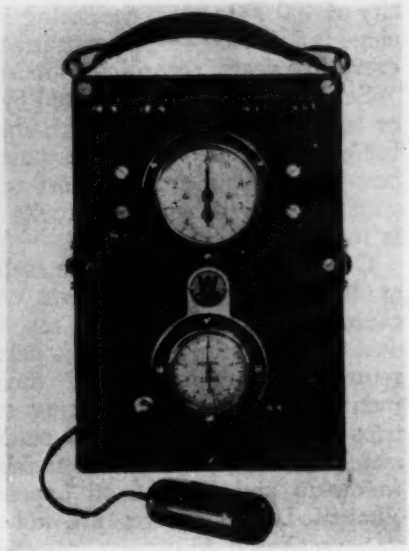


Fig. 1 a, b, c—Co-ordinated house service—outdoor meter, load-center domestic circuit breaker and portable stroboscopic meter tester—proposed to solve customer service problems

Blank meter receptacle can be omitted if there are no prospects of dividing metered circuits

What it will cost to install co-ordinated house service (estimated)

Service	Outdoor Meter (Amp.)	4-gang Load Center Breaker	Estimated Cost of Meter and Breakers Installed* in Lots of 1,000	10,000	50,000
No. 6	5	type A	$24.85	$22.00	$20.50
No. 4	15	type B	27.00	25.00	22.00
No. 2	50	type C	33.00	31.00	29.00

*Wiring included from service attachment to breakers, but excluded from breakers to loads.

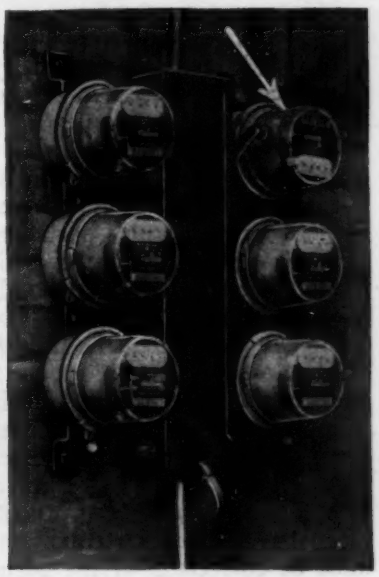


Fig. 2—Group of outdoor detachable meters

Note meter which is upside down, disconnecting service.

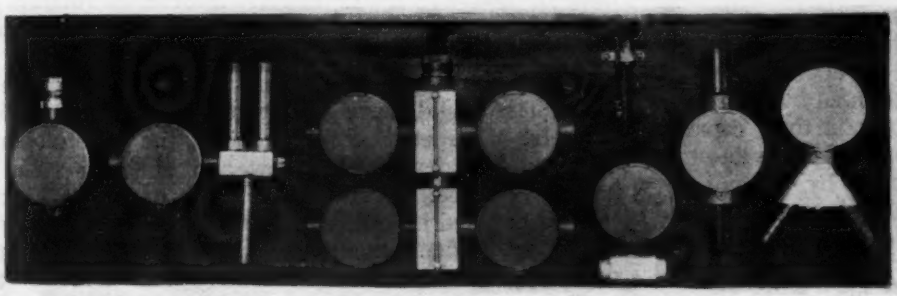
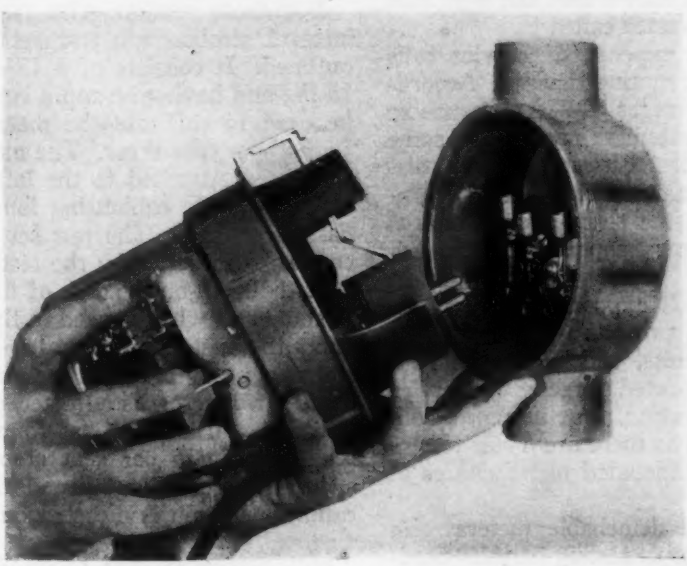


Fig. 3—Various forms of detachable meter service fittings



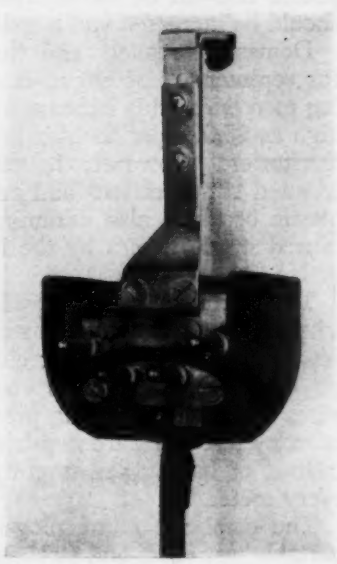


Fig. 4 a and b—Meter with test jack attached being inserted in receptacle preparatory to test

Test jack carried by each tester

city of 400,000 meters the saving from this simplification alone is $500,000—an amount invested for use only once every five years, according to most commission rules.

Service is easily disconnected by pulling out the meter or turning it upside down. Blank covers are available for closing unused meter receptacles. Receptacles have been worked out for the most common forms of construction and division of circuits where multi-metering is required.

Outdoor installation of the meter makes it accessible at all times for reading or test. With indoor meters, because of inaccessibility, it is reported that 15 to 20 per cent of the monthly revenue is delayed one month unless return trips are made. This amount alone is said to justify revamping the metering scheme. When special trips are required the cost of readings goes up approximately as the square of the number of calls. Postcard follow-up and the related expenses of collection are eliminated. Housewives are not interrupted to admit meter men and, vice versa, metermen's time is saved.

For the reasons mentioned previously and later, the outdoor detachable meter is especially adaptable to rural-line extensions, summer resorts, transiently occupied homes and places difficult of access.

Indicating the acceptance of the new outdoor detachable meter, it might be pointed out that in February, 1932, 70,000 meters of this type were in use in the United States, whereas in September, 1932, 100,000 were employed. Two companies are now considering the installation of 110,000 meters of this type. At first they were put in to handle the cases which were repetitively inaccessible for reading. But accessibility was found not to be peculiar to any particular customers. Then the meters were used where diversion was detected or suspected, but the persons who divert power are usually migratory. Houses or places having transient or seasonal occupants constituted the next field of applications.

The domestic breaker cannot be shunted by a "penny" and prevents overloading circuits beyond their capacity when properly selected. Interruption to service due to a momentary overload is not prolonged by waiting for service calls, and the breaker can be immediately and conveniently reclosed. If it continues to trip out it indicates that some faulty condition in wiring or appliances must be corrected. If the wiring is overloaded the repeated trip-out of the breaker shows that the wire size should be increased and a contractor called in.

Domestic breakers end the expense of service calls for replacement of circuit-interrupting devices. According to reports, this expense averages $2,770 and runs as high as $3,000 per thousand customers per year in some territories. However, it varies between widely distributed rural sections and congested city sections. Domestic breakers also minimize the short-circuit hazards caused inside homes by the heavy copper services such as No. 2.

The portable test jack, which exposes no live parts, when inserted or while in use, protects the meter tester from line-to-ground short circuits, which must be considered when a meter is connected directly to service wires without intervening protection. Furthermore, only as many test jacks are required as there are meter testers instead of having permanently installed test facilities at every meter.

The combination of plug-in detachable meters with portable test jacks and stroboscopic testing permits dead-front, outdoor testing, even in inclement weather. Not more than one minute (as low as 30 seconds) is required for the "as found" and light- and heavy-load calibration tests combined, compared with 10 to 30 minutes by the older cut-and-try methods. Inserting and removing the test jack requires only a short interval, but if a momentary interruption of the customer's service is prohibited, a receptacle attachment for automatically maintaining circuit continuity can be applied.

Utilities are not confined to outdoor testing with this plan. The meter may be replaced by a tested meter brought from the central or district stock. Or a group of meters may be temporarily replaced by tested meters, brought to a central, district or temporary community quarters for test and returned to their original locations.

To give some indication of the saving in space and time permitted by the stroboscopic test on a production scale, it might be pointed out that the Westinghouse company has practiced what it preaches. By so doing in its Newark plant it has been able to test in one-third the space as many meters as it did formerly. Of course, this includes savings obtained by being able to install other automatic machinery in the space saved. Production-line stroboscopic testing in a central laboratory as distinguished from cut-and-try testing may easily save 75 per cent of the actual testing time or 45 per cent of the total testing time ordinarily involved. Used in temporary community quarters, this method may save 45 per cent of the old individual testing time.

The chief objections which may be raised to production-line testing of house meters would probably include the added stock of replacement meters required, the necessity of having meter testing rules changed and the need of adapting meter history records to rotation of meters. However, the number of reserve meters required would be small—only enough to replace one group of meters while they are being tested. Change of meter test rules would have to be taken up by utilities. To solve the meter record problem, the Westinghouse company has developed a new and simple system of keeping records. It involves a form of meter history card record and an automatic sorting machine, like used in accounting departments, and will probably expand the usefulness of accounting machines and place meter records on a more or less automatic production basis.

For those readers who are not acquainted with the integral stroboscopic test set‖ a few features will be outlined. It consists of a $12\frac{1}{2}$x$6\frac{1}{2}$x$8\frac{3}{8}$-in. case, weighing 15 lb., and having on top a rotating standard, which can be used to calibrate the meter or set to give the "as found" per cent error. The meter load is external to the test case. Attached to the latter is a portable test jack and a portable calibrating lamp that looks like a small flash lamp case. The test set and meter under test are connected in series by the test jack.

If the teeth on the disk of the meter under test appear to stand still when viewed in the light of the stroboscopic lamp the meter is accurate. Should the teeth of the meter appear to move backward or forward the "as-found" test screw is adjusted until the disk teeth appear to stand still and the "as-found dial" on the test set is read *directly* in per cent error. Then the "as-found" adjustment screw is returned to zero and the stroboscopic calibrating lamp is directed on the meter teeth for cali-

‖*See "Electric Journal," January, 1931, page 39.*

bration at full load and light load. Adjustments are made with the "full-load" and "light-load" screws separately to make the meter disk teeth appear to stand still.

The time required for these tests, including a check test, has been previously mentioned as thirty seconds to one minute. The method removes the elements of human error encountered in customary test methods.

In conclusion, the reader is referred to the outline of benefits which accrue to the customer, public utility, contractor, dealer and electrical manufacturer listed in the second paragraph.

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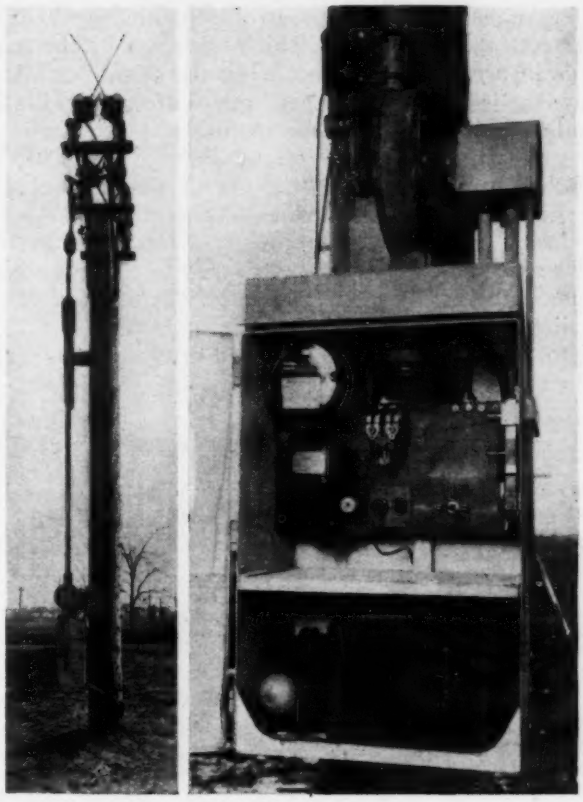
Automatic Air-Break Switch Reduces Outage Time

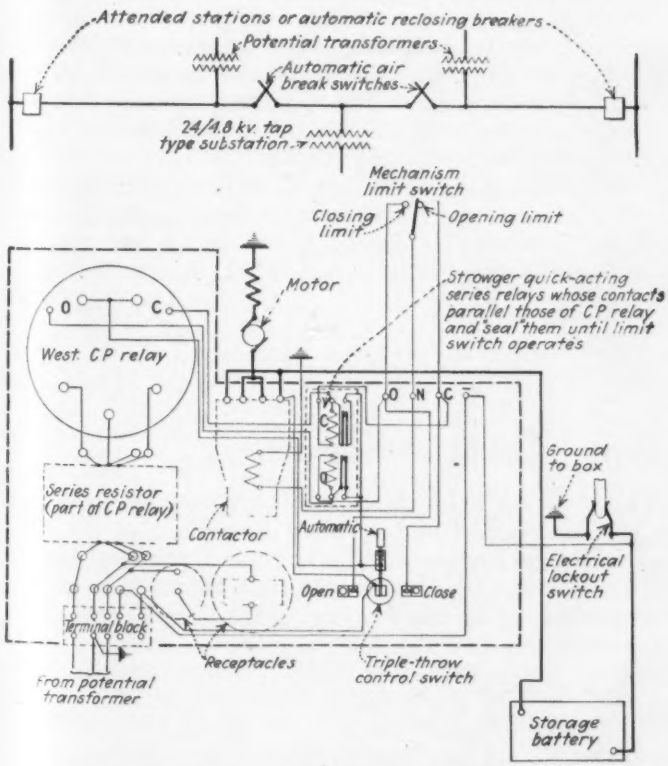
By R. E. GREENE

Engineering Division
Detroit Edison Company, Detroit, Mich.

To isolate faulty sections of line and to provide prompt restoration of service to stations fed by a tap from a line between two switching stations an electrically operated pole-top switch has been designed by the Detroit Edison Company. A satisfactory experimental unit has been built and tested. In the near future an installation will be put in service. It will open and reclose on loss and restoration of voltage and is adaptable to remote control. One such switch is used on each side of the tap connection and the arrangement is such that the tap station will be automatically reconnected to the section of the tie line not in trouble upon reclosure of its breaker.



Automatic pole-top switch



Electrical scheme of automatic air-break switch

At the top is shown the location of the air-break switches in the line and the manner of their functioning in conjunction with the operations of the oil circuit breakers at the ends of the line. Below is a connection diagram of the control and operating circuits of the automatic air-break switches. The triple-throw control switch has been replaced in revised design by a double-throw switch whose positions provide for automatic or manual control.

As shown in the drawing there is a potential transformer on the line side of each of the two air-break switches between which the tap station is connected. Each of these potential transformers is connected to a Westinghouse CP voltage relay, which in turn controls the driving motor of the operating mechanism of the switch. When a fault occurs on the line the circuit breakers at both ends open. This causes both CP relays to lose their voltage and to close their "opening" contacts, completing the circuit through the closing coil of a contactor which connects the driving motor to a 6-volt storage battery. The action in both switches is the same and both open. As there is no voltage on the line they do not interrupt any current.

When either section of the line is re-energized by closing its breaker the corresponding CP relay starts to close its "closing" contacts. If the section in question happens to be the one in trouble and the fault has not cleared the breaker will trip again before the CP relay has had time to close. If the trouble has cleared or if the unfaulted section is being reclosed the corresponding CP relay will complete its action after a short time delay, indicating that voltage of the correct magnitude and phase balance has returned to the line. This causes the contactor again to connect the driving motor which closes the switch and restores service. If the fault has cleared, both switches will be closed in this manner and conditions will be the same as before the fault occurred. The motor drives the switch through an over-running clutch and a spring similar to an "H" type breaker so that the switch opens or closes rapidly regardless of the speed of the motor. The

spring is built into the control rod and the clutch is built into the worm gear, which is driven by the motor.

To insure positive contact when the closing coil of the contactor is closed "sealing-in" relays are used, with their windings in series with the closing coil and their contacts in parallel with those of the CP relay. Limit switches are provided to stop the driving motor at the proper point of travel after it has performed an opening or closing operation. By means of a small double-throw knife switch the air-break switch may be made automatic or manually controlled. The battery is charged from a small trickle charger. A hand lever is provided at the side of the mechanism box to open or close the air-break switch by ratchet action.

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READERS' FORUM

Claims Oil Specifications a Help and Economy

To the Editor of the ELECTRICAL WORLD:

The article by K. N. Newman in the June 4 issue on "Why You Can't Buy Oil on Specifications Alone" is somewhat misleading in that it implies that no tests on oil are of any use to the purchaser in determining the quality of this material. This is far from being the case.

Using in addition to the tests cited by Mr. Newman other tests which are familiar to every oil chemist, it is quite practicable to differentiate between the quality of various oils. Knowing the viscosity required for proper lubrication at the approximate operating temperature of the oil, it is possible to choose with certainty an oil which will be satisfactory for the service in point. This has been amply demonstrated over a period of years by the experience of the organization with which the writer is connected.

Mr. Newman lays great stress on dealing only with reputable, experienced oil producers. Any one who deliberately deals with the tricky or inexperienced oil companies, with or without specifications, has no one but himself to blame if he has trouble with the oil purchased. But he is very much more apt to detect fraud if he checks by proper tests the quality of the oil received. However, even in dealing with reputable organizations whose intentions are of the best, there are still some of the elements of a "horse trade" remaining. No matter how well they are equipped with research laboratories, experts, technicians and engineers, their recommendations are sometimes wrong. In such cases the customer is the loser.

A few examples from the experience of this company are interesting in this connection. The manufacturers involved were responsible companies, having research laboratories at their command, and would fully meet Mr. Newman's tests for integrity:

1. Some years ago we purchased a tank car of lubricating oil on specifications. A well-known leading oil company that had been supplying oil for this purpose stated that the oil we were purchasing would gum our bearings and cause no end of trouble to our operators. This oil has given perfect satisfaction for seven years, and is still in service.

2. Several reputable manufacturers were asked to submit to our laboratories samples of the oil they recommended for a certain purpose. With one exception all the oils had the same viscosity at the working temperature of the bearing and from the tests referred to by Mr. Newman would be considered equal. However, on the steam emulsion test they showed a variation of 47 to 480 seconds. On an oxidization test made by heating the oils to 248 deg. F. for 72 hours with oxygen bubbling through them, the amount of solid products formed in the different samples varied from nothing to 0.37 per cent by weight. On a heat test some of the oils did not lose their golden color, whereas others changed to a black color. The neutralization value was less than 0.05 with all the samples except one, which was 0.40. These tests would indicate that although all the oils had similar physical properties, they varied considerably in quality.

3. An oil was purchased for one of our plants on the recommendation of one of the largest and most reputable oil companies. This oil had a poor oxidization test and after one year in service it developed sludge at a rapid rate and had to be discarded.

4. At another of our plants an oil was purchased on the recommendation of a reputable manufacturer who features the "oiliness" of the film. This oil deposited a bituminous-like sludge and the bearing temperature increased. It was necessary to discard this oil after a short period of service.

There are cases where it is difficult or inadvisable to purchase oil by specifications, but for the majority of uses oil can be purchased by specification to the advantage of the user. The specifications should include other tests than those listed by Mr. Newman and the tests should be made by an experienced laboratory man who understands oils. To the small user of oil this may be impossible and he will have to depend on the integrity of the manufacturer and the experience and knowledge of the salesman, but the big purchaser of oils will find the use of specifications both a help and an economy.

W. P. DOBSON,
Chief Testing Engineer.
Hydro-Electric Power Commission of Ontario,
Toronto, Canada.

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Room Count at Malden

To the Editor of the ELECTRICAL WORLD:

A correction should be made in connection with the rate schedules published in ELECTRICAL WORLD, August 13, page 208, regarding the Malden Electric Company's room data. Schedule A as printed is in reality the company's commercial rate B-1, and the correct tariff is as follows for schedule A: Service charge, 50 cents per month; first 15 kw.-hr. at 6½ cents net; next 55 kw.-hr. at 5½ cents net; excess over 70 kw.-hr. at 3½ cents net.

Schedule A-1 as printed is 1 cent high in the first block (having been reduced since the initial tabulation filed with the commission) and is now: First 4 kw.-hr. per room per month at 7½ cents; next 4 at 5½ cents, and excess over 8 kw.-hr. per room per month at 3½ cents.

V. M. F. TALLMAN,
Executive Assistant.
Charles H. Tenney & Company,
Boston, Mass.

Men of the Industry

J. W. Barker New President of I.E.S.

Joseph W. Barker, who was elected president of the Illuminating Engineering Society (ELECTRICAL WORLD, October 8, 1932, page 488), has been dean of the faculty of engineering of Columbia University since the spring of 1930. As an educator in the engineering field Professor Barker has a broad background

of experience, having been an associate professor of electrical engineering at the Massachusetts Institute of Technology for a period of four years and professor of electrical engineering, head of the department of electrical engineering and director of the curriculum in electrical engineering at Lehigh University in 1929-1930. It was following this connection that he was appointed to the Columbia faculty.

Before entering upon this academic work Mr. Barker had a colorful military career, his assignments taking him to Virginia, Oklahoma, France and Germany. In addition to being active in the Illuminating Engineering Society he is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers, the American Society of Civil Engineers and the Society for the Promotion of Engineering Education.

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N.E.L.A. Makes New Appointments

Announcement has been made by the National Electric Light Association of the appointment of Major Howard S. Bennion to the position of assistant executive director. Major Bennion was formerly director of engineering of the association and will be succeeded in this office by Alexander Maxwell, who has been with the association since 1923. Lucy Bioni, who had served as acting director of information and service since the resignation this spring of George F. Oxley, has been appointed to the newly created position of secretary of the National Economic Section.

▼

R. P. Smith Heads Potomac Edison

R. Paul Smith, who was elected president of the Potomac Edison Company, Hagerstown, Md., as announced in the September 24 issue of the ELECTRICAL WORLD, has been connected with that utility and its predecessors since he was graduated from Blue Ridge College in 1909. At that time the property was known as the Washington, Frederick & Gettysburg Railway Company and Mr. Smith joined the staff as clerk in the office of the general manager. From that humble beginning he advanced successively to the position of agent, general agent, accountant, traffic manager, district superintendent and general superintendent, in the last-named capacity directing the railway, gas and electric departments.

In this executive position he was highly successful and when the company

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was reorganized as the Potomac Public Service Company he was appointed general manager. In 1923 certain properties were merged with the Potomac Public Service Company to form the Potomac Edison Company and three years later Mr. Smith became vice-president. In addition to being president, Mr. Smith was elected to membership on the company's executive committee and on the board of directors.

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M. F. RILEY, formerly president of the Potomac Edison Company, Hagerstown, Md., has been elected chairman of the board of directors and of the executive committee to fill the vacancy created by the resignation of E. L. Coblentz. Mr. Coblentz was retained in a consulting capacity.

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JOHN G. LIVINGSTON, electrical contractor of New York, has been elected president of the Electrical Guild of North America, to succeed L. H. Comstock, who organized the association.

•

J. E. E. ROYER, who recently became vice-president as well as general manager of the Washington Water Power Company (ELECTRICAL WORLD, June 18, 1932, page 1071), was elected president of the Northwest Electric Light and Power Association at a recent meeting.

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OBITUARY

JERALD F. DAVIS, general manager of the Graybar Electric Company, Inc., in New England, and one of the best-known figures in the northeastern wholesaling field, dropped dead September 29 while talking to associates at the Buffalo convention of the National Electrical Wholesalers' Association. He was apparently in the best of health when a heart attack overcame him. Mr. Davis was born at Newport, Ind., in 1884 and was educated at Culver Military Academy and Purdue University. His entire business life had been spent in the employ of the Graybar company and its predecessor, the Western Electric Company. From 1919 to 1923 he was New England sales manager, and from 1923 to 1927 he was manager at the New York office, returning to Boston five years ago to take charge of all the company's New England interests. He was a past-president of the Metropolitan Electrical League of Boston.

•

CHARLES S. MCGILL, who was identified with the Delaware Power & Light Company, Wilmington, Del., as plant superintendent, died late in August, 1932. Mr. McGill obtained his early experience in the electrical industry with the Columbus Edison Company at Columbus, Ohio, but after a short connection, he joined the Westinghouse Electric & Manufacturing Company. He left the electrical industry to engage in other work, returning after a few years as assistant sales manager of the Western Electric Company in Cincinnati. In 1909 he was appointed sales engineer for Allis-Chalmers Manufacturing Company, Cleveland. Returning again to Cincinnati in 1911 he became branch manager of the Crocker-Wheeler Company, four years later returning to the Allis-Chalmers Manufacturing Company at Huntington, W. Va., as branch manager. In 1916 he engaged in power engineering with the Wilmington &

Philadelphia Traction Company, and a year later was advanced to the office of electrical superintendent.

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Cyprien O. Mallioux

Dr. Cyprien O. Mailloux, distinguished scientist and engineer, died suddenly, October 4, at his home in New York in his seventy-second year. Dr. Mailloux was well known to the engineering profession both in this country and abroad for his contributions to the development of the science and art of electrical engineering. Perhaps the greatest achievement of his useful career was the organization of the International Electrotechnical Commission, on which he

did much of the pioneer work. Difficulties presented themselves in the early work of this commission and it was due largely to his efforts at the first meeting in 1908 that the undertaking was not abandoned. Subsequently he attended practically every meeting of the commission and on these occasions the value of his technical knowledge was enhanced by his linguistic accomplishments, enabling him to converse freely with the engineering celebrities of other nations in their native tongue. He became president of the commission in 1919 and at the time of his death was serving as honorary president.

Dr. Mailloux was a charter member of the American Institute of Electrical Engineers and after serving in many official capacities he was elected president during 1912-1913. To the technical press in this country and abroad he contributed many articles. He attracted wide attention with his valuable series of articles on dynamo-electric machines published in 1882 and the following year he became the first editor of the ELECTRICAL WORLD. In the same year he established the consulting engineering practice which since has covered activities in many important branches of the art both domestic and foreign. He represented the United States government on the commission sent to Europe in 1916 for international research in both the industrial and scientific branches of electrical engineering. The French government honored him by naming him an officer in the French Legion of Honor in 1922.

New Equipment Available

100-Amp. Flex-Arc A. C. Welder

A special transformer and control designed for alternating-current arc welding at comparatively low current values is comprised in the new Westinghouse 100-amp. flex-arc a.c. welder. It is rated at 220-440 volts, 50-60 cycles, single phase, with current range of 4 to 125 amp. Some of the features are: Safety to the operator is made possible by an exclusive stabilizing circuit which eliminates the usual high open-circuit voltage at the working electrode; high operating economy is made possible by a high average power factor and extremely low no-load power requirements.

▼

Elapsed Time Indicator

An elapsed time indicator, designated type SM, designed primarily for indicating the length of time a feeder circuit is de-energized is announced by the Automatic Switch Company, Detroit, Mich. An auxiliary switch mechanically connected to a circuit breaker closes the elapsed time indicator circuit when the circuit breaker is open. When used with an automatic reclosing device it is usually desirable to have the indicator record only the elapsed time after the reclosing device has made a predetermined number of reclosures into a permanent line fault and locked out.

It is driven by a self-starting synchronous motor and the housing, which can be mounted either indoors or outdoors, takes up little space. It is available in 100 and 220 volts at commercial frequencies.

▼

A DEVICE FOR THE artificial production and distribution of Ozone, known as the Jefferson "Ozonator," is announced by the Jefferson Electric Company, Belwood, Chicago. The design and small size of the "Ozonator" make a controlled supply of additional ozone for purifying, vitalizing and deodorizing offices, bedrooms, sickrooms, etc.

•

A LINE OF DISH WASHERS offering a number of refinements has been announced by the General Electric Company. One of the outstanding features of the new line is the magic control, which makes the whole operation of the machine as easy as turning a switch. As the trays are filled with dishes and the cover lowered there is nothing more to do but to turn the control. The entire control mechanism is contained in a small box. Among other features is a little device called a crum-cup, which is standard equipment on all combination sink models. This crum-cup gathers crumbs and particles of food and is removable.

▼

Horizontal Drilling With Electrically Driven Machine

An electrically driven drilling machine which the manufacturer claims will revolutionize the method of shooting earth structures in places where the vertical face of the material to be shot is available and when the material consists of slate, shale or other material softer than hard sand-rock or limestone is announced by the Allendale Manufacturing Company, Indianapolis, Ind.

One of the advantages of this machine is the ability to so space and load the holes as to put the explosives exactly where wanted, and in the proper amount, thus getting a maximum amount of breaking effect with a minimum amount of explosives. Where there is strata in which this drill can work, such as slate or shale, this drill is effective, it is claimed, even if there are heavy bands of hard stone above, the lighting and shattering effect when a battery of these horizontal holes is shot being sufficient to break up overlying ledges of rock.

▼

PLUG-IN METER TEST BLOCKS which permit easy connection and removal of the meter are announced by the Square D Company, Detroit, Mich. The new block does away with meter loops and cross-overs in the meter connections. All cross-overs are provided in the base of the block and the meter terminal connections slide down over semi-rigid connectors. The block is built for indoor and outdoor meter cabinets.

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AN ADDITION TO ITS R.B. INDUSTRIAL SWITCH LINE of the 30, 400, 600 and 800-amp. sizes, making available a complete line of R.B. switches 30 to 800 amp. inclusive, two, three and four pole, 230 and 575 volts a.c., both side and front operated, is announced by the Trumbull Electric Manufacturing Company, Plainville, Conn.

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A FULL LINE OF PORTABLE CORDS AND CABLES having a special outer sheath which is impervious to the destructive action or grease known as "Oilproof Okocord" has been announced by the Okonite Company, Passaic, N. J. It is suitable for use around machine shops, garages, refineries, oil wells, etc.